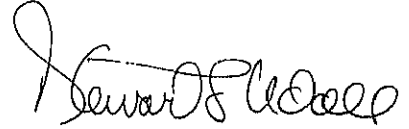


*Prepared by* . . . The United States

The purpose of this booklet is to bring a new awareness to the American people of our rich natural resource heritage, its history, its present, and its future. To know our land is to love it and cherish it and protect it from the ravages of both nature and man.



SECRETARY OF THE INTERIOR

U. S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

# Natural Resource of Washington

Department of the Interior • Office of the Secretary • Division of Information

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# Table of Contents

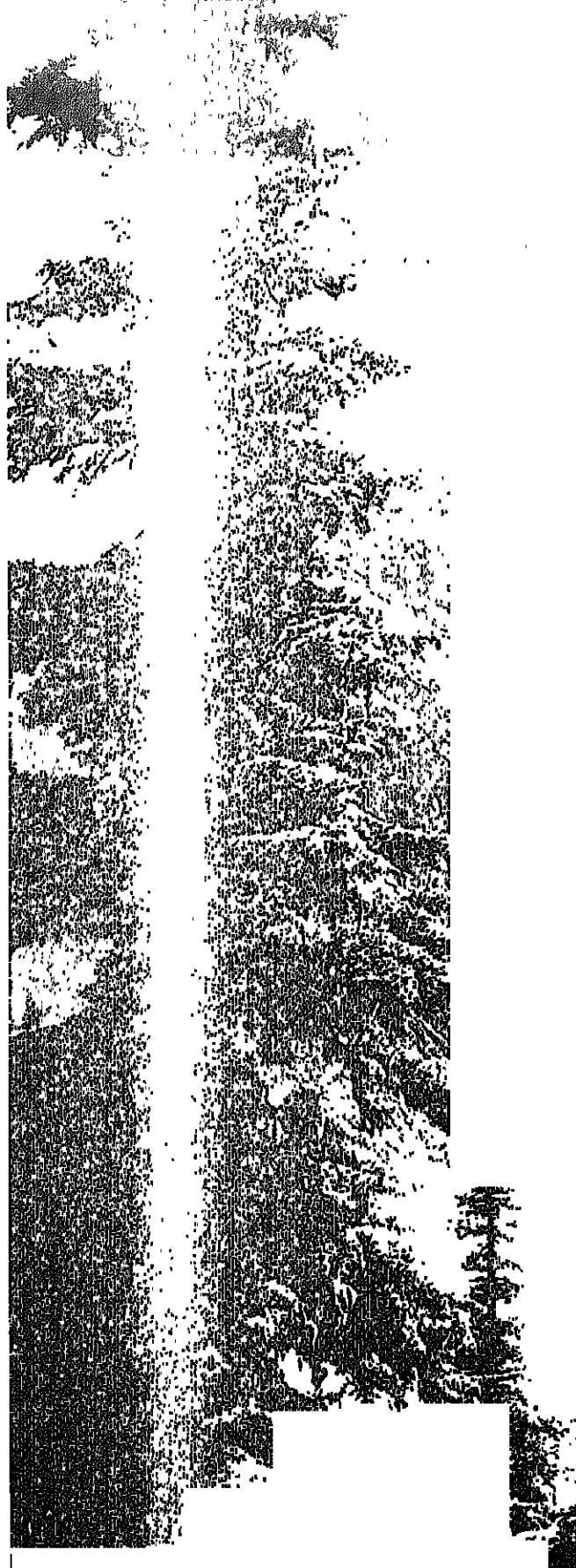
	<i>Page</i>
Introduction and History . . . . .	6
Physical Characteristics of Washington . . . . .	10
Park and Recreational Resources of Washington . . . . .	12
Water and Power Resources of Washington . . . . .	20
Fish and Wildlife Resources of Washington . . . . .	26
Mineral Resources of Washington . . . . .	28
Land Resources of Washington . . . . .	32
Indians of Washington . . . . .	40
Geologic History . . . . .	42
Programs of Federal Natural Resource Agencies . . . . .	48
Bureau of Reclamation . . . . .	48
Bonneville Power Administration . . . . .	50
U.S. Army Corps of Engineers . . . . .	51
Geological Survey . . . . .	54
Bureau of Mines . . . . .	56
Bureau of Indian Affairs . . . . .	59
Bureau of Land Management . . . . .	60
U.S. Forest Service . . . . .	62
Fish and Wildlife Service . . . . .	64
National Park Service . . . . .	68
Bureau of Outdoor Recreation . . . . .	70
Summary . . . . .	71

## CREDITS

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## Introduction and History

A century ago, the State of Washington—called the Evergreen State—was largely wilderness. The eastern portion was a semiarid region of plateaus and rolling hills where sagebrush and bunch grass grew, where coyotes and jackrabbits roamed. Homesteaders were placing their roots in the rich desert soil and Indians hunted and fished—living their communal life unhindered by the pressures of the thinly scattered western settlers—and the Columbia River rushed to the sea.

Forests of lodgepole pine, fir, and tamarack covered the high ground and the eastern slope of the great Cascade mountains. The works of nature were abundant, and the scars left by the hands of man rarely visible.

On the western side of the Cascades, dense forests also grew—great stands of spruce, Douglas fir, cedar, and hemlock—broken in many areas only by Indian trails and the skid roads of early loggers. Rhododendrons—the State flower—white dogwood, catkins of maple and alder added the flame of nature to the land.

Within these forests, bear, beaver, deer, elk, and cougars lived in natural habitat. Mink and otter fished the bountiful streams in nature's balance. Birds—the grouse, ptarmigan, duck,

and geese sought the shelter of inland lakes, and porpoises played in the Sound and Strait.

Much of this remains today . . . but the inexorable march of man and man's civilization has transformed the Evergreen State. It has left its mark on the land. Today, Washington shows the vast alteration wrought by the settlement of the 19th century and, conversely, also stands as a monument to the greatness of later conservation efforts by the men who restored the land resources destroyed by earlier depredations.

Forests have been harvested. Grassland has bloomed under the plow of the wheat farmer. Ranges support cattle and sheep. Desert land has been turned into productive fields and orchards by the magic wand of irrigation with water from the mighty Columbia River and its tributaries. Trains and autos follow rail and asphalt where once the Indian silently walked. Steamships and ferries cross the waters, and airplanes trail their jet streams overhead. Where the fish net of the Indian once dipped into the waters, factories and mills now stand.

On one hand, the thoughtful man can see tangible evidence of the toll of haphazard development and also he can see the works that





The forests and mountains of the Evergreen State are the sources of its most important resources.

are designed to conserve and reclaim the resource heritage of the Evergreen State. To see, and to understand the forces at work, is to gain a clearer perspective of the history—not only of Washington—but of the Nation itself.

Selective logging, often called sustained yield management, has replaced the random ax of the woodsmen. Great dams and fish ladders have been built. State and national parks spread across the land. All of these measures are expressive of the citizens of Washington—people of pioneer spirit, broad vision, and with the capacity for patient planning.

### *Early Exploration*

The seafarers of the 16th and 17th centuries—in search of the fabled Northwest Passage to the Orient from the Old World—came first to the Evergreen State. The claims of first discoveries are clouded in history, but the names of Francis Drake, Juan de Fuca (after whom the Strait is named), Juan Perez, Captain Cook, La Perouse—all have significance in the discovery of the wonders of Washington.

Next came the inevitable fur traders, first

settlers of the land, who were there not to develop the soil but to plunder its resources. It was in 1788 that the American Flag first came to Washington when Captains Gray and Kendrick in the ships, the *Washington* and the *Columbia*, explored the coast. It was Robert Gray who anchored off the north bank of the river, traded with the natives, and named the river after his ship, the *Columbia*.

As hope for finding a northwest passage faded, England and the United States began a long contest for possession of the lands north of California—all of which were called the Oregon Territory, the vast area bounded on the east by the Rocky Mountains and extending indefinitely northward.

Thomas Jefferson, following the Louisiana Purchase from France in 1803, sent the Lewis and Clark expedition northward across this vast area and into the Oregon land. Descending the western slopes of the Rockies, they discovered the Salmon, Bitter Root, Clearwater, and Snake rivers, following the Columbia to its mouth where they wintered in a camp called Fort Clatsop—now preserved as part of the Department of the Interior's National Park System.

The development of American trading posts

and further explorations continued over a period of years with trips by Captain B. L. E. Bonneville and Lieutenant John C. Fremont into the 1840's. About 1834, American missionaries moved into the Oregon territory. In 1839, it was estimated that only 151 Americans were residing permanently in the area, but an influx made Americans as numerous as British and French by 1844, with other settlers on the way.

### *First Government*

A provisional government, using the laws of Iowa—the only law available in book form—was established. While theoretically, this government was to serve the entire territory, it functioned only along the lower Columbia and in the Willamette Valley. By 1844, the problem of the British-American counterclaims had taken

within the present limits of Seattle, as well as other places were founded. Because of poor roads and the inclination of the territorial government to slight the north, there was growing sentiment for a division of the territory into two parts. In March of 1853, this division took place and the Washington Territory was established covering the present State, western Montana, and northern Idaho.

Lumbering became the principal industry, particularly following the discovery of gold in California. Indian problems also arose and despite treaties with the Nez Perce, the Cayuse, the Umatilla, the Walla Walla, the Kamiakin, and the Yakima Indians, border massacres and fights were occasioned for a number of years, ending finally in 1878. West of the Cascades, Indian troubles—such as the siege of Seattle and wars in Puget Sound—also brought trouble to this area.



The rain forests of Olympia National Park in Washington are one of nature's miracles.

on national significance and provided the election campaign slogan, "Fifty-four-forty or fight."

The national ownership problem was eventually resolved when England, enmeshed in continental problems, compromised with a treaty placing the boundary at the 49th parallel with the English retaining Vancouver Island.

Final United States approval of the territory came in August 1848, and the first United States governor of the new territory was General Joseph Lane who took the post following a declination of the job by Abraham Lincoln.

### *Rapid Expansion*

Early settlers of the Oregon Territory made their homes near the Lower Columbia River. However, after the 1846 treaty, the Puget Sound area also became settled rapidly, and by 1851 the village of Olympia, and a settlement

During the Civil War, sentiment in Washington territory rested mainly with the Union, and peace prevailed with the exception of a few scattered incidents involving Confederate sympathizers. Ten companies of volunteers manned military posts, releasing regulars for combat duty elsewhere. During the war, in 1861, the Territorial University, now the University of Washington, was founded.

Also by 1861 the eastern portion of the territory had become as heavily populated as the western zone, and in 1863, the Idaho territory was carved out—leaving Washington with nearly its present political boundaries. The movement for statehood was also on. With the development of rail communication and telegraph facilities, direct communications with the remainder of the Nation became accomplished by 1887. In 1889, an enabling act was passed by the Congress, and Washington was

authorized to become a State on February 22, 1889. Formal organization was effected on November 11, 1889, and the capital was established at Olympia.

*Washington Today*

When Washington was admitted to the Union, it had a population of 357,232—an increase of 375 percent since 1800. Today, the latest Federal census shows a population of nearly 3 million. The rate of increase between the two last censuses was 19.9 percent.

This dynamic growth of the Evergreen State continues, and rests principally on the wise development, prudent conservation, and intelligent use of the major resources of Washington. The Department of the Interior is—and continues to be—active in resource development in Washington, and is proud of the role it has played in keeping the Evergreen State "green."

The principal population complex in Washington is found around the Puget Sound, where the principal cities of Seattle, Everett, Tacoma, Bellingham, and Olympia, and others are located. The State has become a great commercial center and, harkening back to the early explorers, a principal American gateway to the Orient.

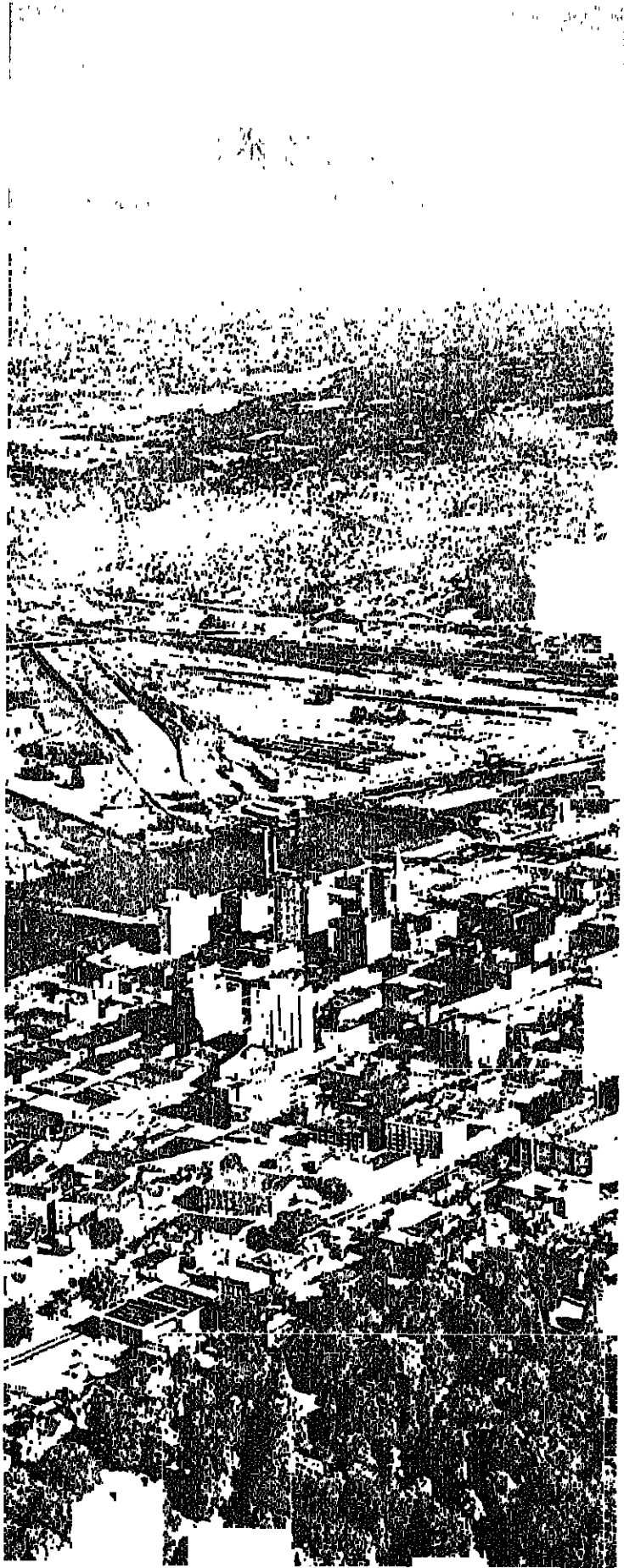
Washington is also an important agricultural State—it produces a great variety of crops, commercial foodstuffs, fibers, and fishery products. Industrially, the State with its complex of hydroelectric facilities is highly developed. There we find major West Coast industries in forest products, food processing, aircraft, chemicals, minerals, metals, and, of course, Washington is the site of the great Hanford works of the Atomic Energy Commission.

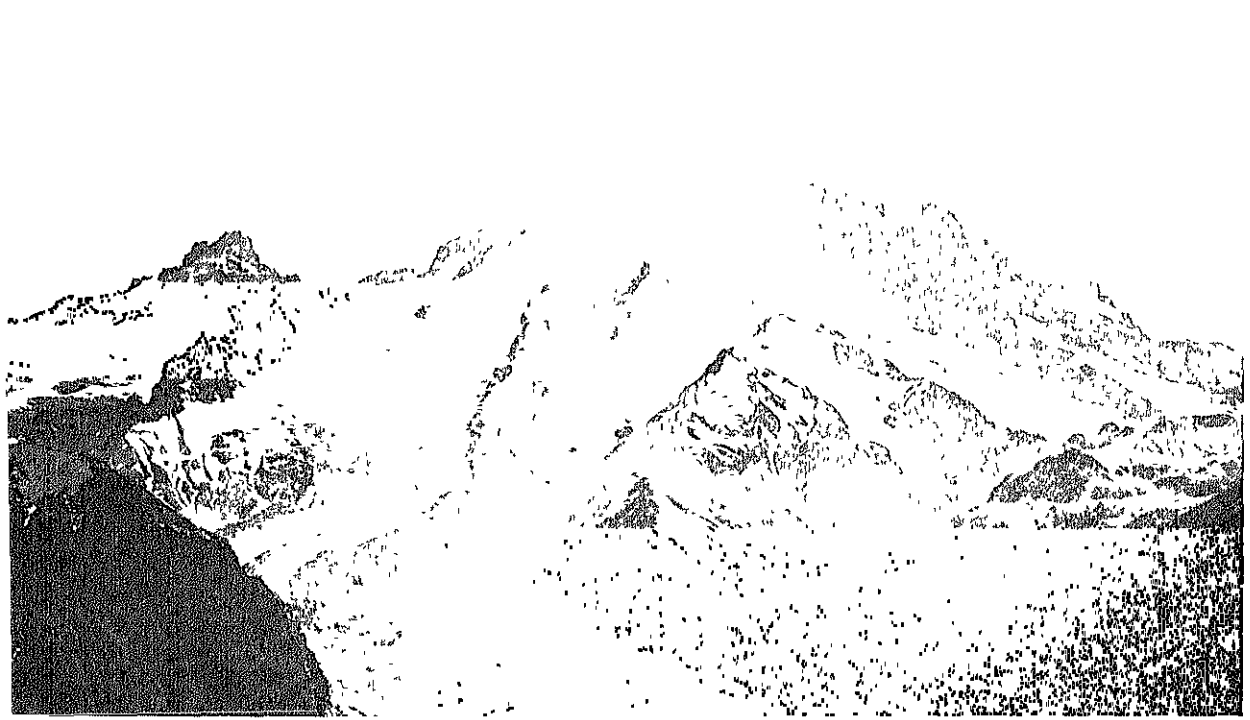
The State has 23 colleges and universities with the principal ones being University of Washington, Washington State, and Seattle University.

Principal Cities

Aberdeen	Olympia	Vancouver
Bellingham	Renton	Walla Walla
Bremerton	Seattle	Wenatchee
Everett	Spokane	Yakima
Longview	Tacoma	

Aerial view of downtown Tacoma, Wash., and portion of its harbor, looking southeast toward perpetually-snowcapped Mount Rainier, 14,410-foot sentinel of the Cascade range. Located on Puget Sound, Tacoma is a major North Pacific port and an important manufacturing, distribution, and transportation center.





## Physical Characteristics of Washington



The State of Washington covers an area of 43,642,880 acres, larger than New England, of which about 890 thousand acres are inland waters. Its shoreline, including the ocean shore, the inland shore, and islands, totals approximately 2,700 miles—of which 175 miles fronts the Pacific Ocean.

Washington is a State of several mountain ranges—the principal ones being the Cascades and the Olympics. The Cascade mountains, averaging 6,000 feet at the crest with higher individual peaks, divide the State from north to south. The two zones differ both geologically and climatically.

The Columbia River enters Washington near the northeast corner and flows southwesterly until it turns westerly to its course to the Pacific Ocean, also separating Washington and Oregon. The Columbia is one of the most extensively developed river basins in the United States.

The annual average temperatures for eastern and western Washington are about the same, ranging between 48 and 50 degrees. However, there are considerable differences in the extremes of the two zones. In western Washington, the moderating effect of the ocean wind keeps summers cool and winters warm. In contrast, temperature extremes in eastern Washington range between minus 22 degrees to highs of 118 degrees.

The barrier formed by the Cascade mountains has a direct bearing on rain and snowfall in the two portions of the State. In certain parts of the Olympic peninsula, moisture-laden Pacific winds have meant rainfalls up to 200 inches per year, the heaviest in the United States, while many of the arid portions of eastern Washington have annual precipitation of five inches per year. The average annual precipitation in the western portion of the State is about 58 inches; in the eastern portion, 17 inches.

Vegetation varies remarkably through Washington—from dense rain forests of the Olympic peninsula to the sage-brush hills of the southern and eastern portions of the State. Between these two extremes are the extensive Douglas fir forests and the ponderosa pine stands of central and northern Washington.



# Park and Recreational Resources of Washington

The recreation potential of the State of Washington is probably larger than any other State in the Union. Of the State's 43.6 million acres, approximately 29 percent—slightly more than 12.6 million acres—is in Federal ownership. Most of the federally owned lands, except for those classified for national security purposes, are available for public recreation use. However, only a very small percentage has been developed for intensive recreation pursuits.

The National Park Service of the Department of the Interior in Washington administers five areas totaling some 1.2 million acres, consisting of two National Parks—Mount Rainier and Olympic, two National Monuments—Fort Vancouver and Whitman; and one recreation area—Coulee Dam National Recreation Area.

The Forest Service of the Department of Agriculture administers National Forests, encompassing about 4.5 million acres, which offer excellent recreational opportunities.

Mount Rainier National Park contains the greatest single-peak glacial system in the United States, radiating from the summit and slopes of an ancient volcano. It has dense forests and flowered meadows. Olympic National Park is

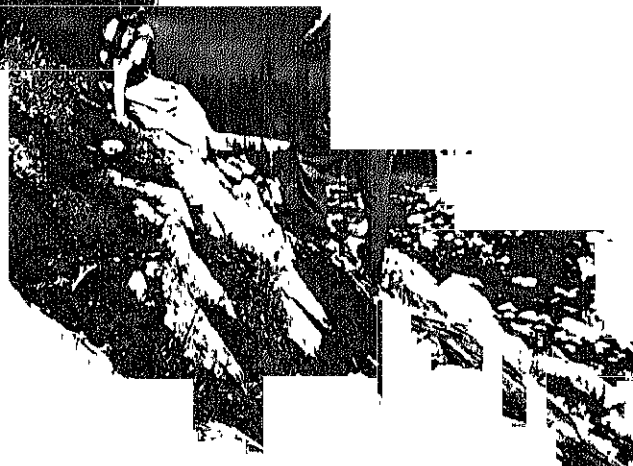
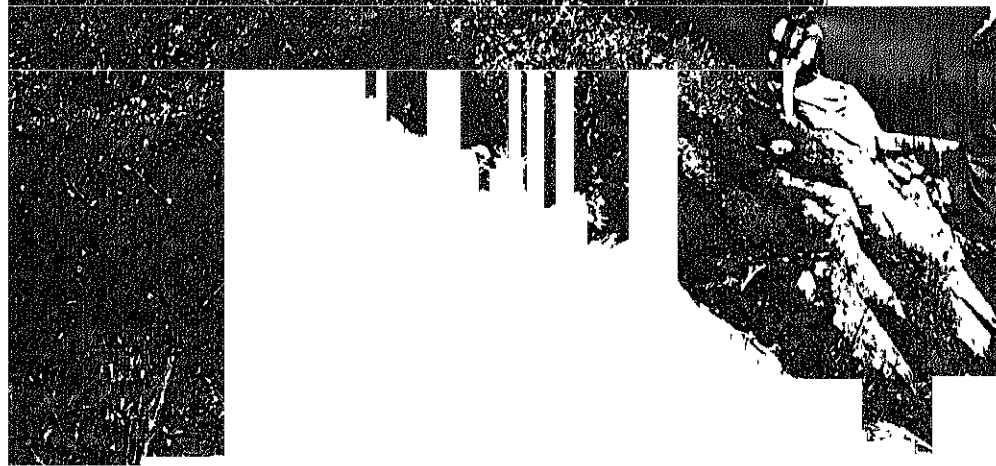
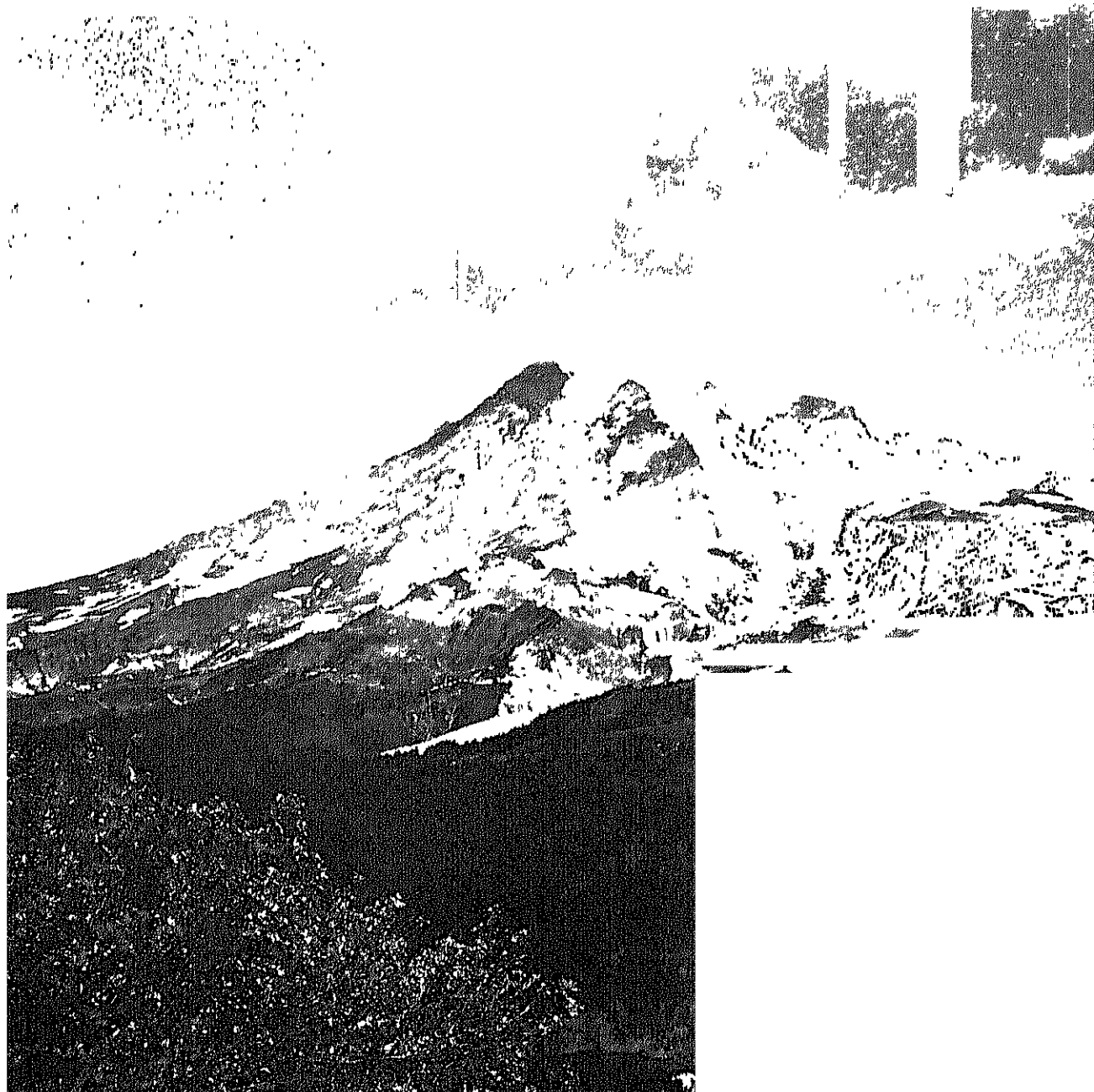
a mountain wilderness with the finest remnant of Pacific Northwest rain forests, active glaciers, and rare Roosevelt elk.

Fort Vancouver National Monument, the one-time western headquarters of the Hudson's Bay Company, 1825-49, and a U.S. military reservation for 100 years thereafter, was for a time the hub of all trading activities and the seat of political and military authority for the vast Pacific Northwest. Whitman National Monument contains the site where Dr. and Mrs. Marcus Whitman ministered to spiritual and physical needs of Indians until massacred by them in 1847. It is also a landmark on the Oregon Trail.

Coulee Dam National Recreation Area is the area around Franklin D. Roosevelt Lake, created by Grand Coulee Dam, which has been developed for recreational use.

## *National Forests*

On the National Forests of Washington, recreation is an important industry. Densely forested, majestically mountainous, the State's Federal lands are host annually to 4,016,400 recreation visitors. Listed below are her



National Forests with their major recreational facilities and gross area indicated.

*Colville*, with headquarters in the town of the same name, covers 1,007,884 acres and includes the Chewelah Peak Ski Area. There are at present 15 camp and picnic areas within this forest.

*Gifford Pinchot* has an acreage of 1,421,080 including over 100,000 acres of wilderness—the Mount Adams Wild Area (42,411 acres) and 59,740 acres of the Goat Rocks Wild Area. Headquarters is at Vancouver and there are 64 camp and picnic areas.

*Kaniksú* has its headquarters in Sandpoint, Idaho. Only about one-quarter of this forest is in Washington, but within this 297,777 acres are nine camp and picnic grounds.

*Mount Baker*, with headquarters in Bellingham, covers 1,851,411 acres and includes nearly half of the famous Glacier Peak Wilderness Area of 213,100 acres, and more than half of the also famous North Cascade Primitive Area—434,200 acres. In this forest is the Mount Baker Ski Area as well as 47 camp and picnic sites.

*Okanogan*, largest of Washington's National Forests, covers 2,090,632 acres, 266,800 of them in the North Cascade Primitive Area. It has 53 camp and picnic areas and one ski area—the Loup Loup. Headquarters are in Okanogan.

*Olympic*, with headquarters in Olympia, includes 689,883 acres and a silviculture research laboratory. There are 15 camp and picnic grounds.

*Snoqualmie*, covering 1,538,142 acres, includes 22,940 acres of the Goat Rocks Wild Area. On this forest is the White Pass Ski Area. Headquarters is in Seattle, and it includes 60 camp and picnic areas.

*Umatilla* lies largely in Oregon, where its headquarters is located at Pendleton. The 321,932 acres of this forest which lie within the State of Washington constitute less than one-third of its total acreage. There are approximately 50 camp and picnic sites in this portion of the Umatilla.

*Wenatchee*, with headquarters in the town of Wenatchee, covers 1,523,346 acres including 245,405 acres in the Glacier Peak Wilderness Area. On this National Forest is the Wenatchee Hydrology Laboratory, the Stevens Pass Ski

resources, Olympic  
tes beside the surf.  
extends through the  
0 miles, providing  
ing, clamming.







Area, and 101 public camp and picnic developments.

### *Many Recreation Resources*

Washington is bountifully endowed with many and varied recreation resources. Its location on the Pacific Coast with its mountains, forests, lakes, and rivers, together with a mild, temperate climate, result in making recreation one of its principal activities.

Recreation and the tourist business are fourth in importance in the State's economy. A State park survey shows the recreation business contributes over \$330 million to the economy of the State, also representing \$13.5 million in taxes to the State and counties.

way in many areas to rough, rocky shores and numerous offshore rocky islands, terminating at Cape Flattery where the Pacific flows into the heart of western Washington through the Strait of Juan de Fuca.

The Olympic Peninsula contains the Olympic National Park which includes the Olympic Mountains, the luxuriant rain forests, rugged coastal headlands, rivers, creeks, and lakes. Here the recreationist can enjoy magnificent mountain and ocean scenery, mountain climbing, hiking, fishing, camping, and various other forms of outdoor recreation. Hood Canal, a natural inland waterway bordering the Olympics for about 60 miles, provides outstanding opportunities for boating, clamming, fishing, swimming, and camping.



The outdoor recreational resources of Washington offer year around attraction and variety.

Washington's coast line on the Pacific extends from the Columbia River to the Strait of Juan de Fuca. U.S. Highway 101, for the most part, parallels the ocean shore providing a ready means of access for the many thousands of recreationists visiting the seashore almost every day of the year.

The principal attractions of this area are the excellent clam digging, swimming, surf and boat fishing, camping, picnicking, and seashore scenery. The southern part of the coast consists of bays and long, wide, sandy beaches. North of the Quinault River, the sandy beaches give

Puget Sound, lying between the Olympics and the Cascades, is probably the greatest single recreation attraction of the State. More than 1,800 miles of shoreline, the clustered San Juan Islands, and numerous other large and small islands provide water-associated recreation activities unmatched any place else in the Nation. It is considered the small-boat capital of the world and probably has more pleasure boats using its waters than any other area of comparable size.

It also offers some of the country's finest fishing, while clam-digging and crabbing offer

additional opportunities to the recreationist. The calm water of the sheltered bays is heavily used for swimming and water skiing. Numerous State parks and forest camps provide the vacationist many opportunities for camping and picnicking.

The Cascade Mountains compete with Puget Sound in providing recreation opportunities to the citizens of Washington and to the tourists from other parts of the Nation. Mount Rainier, the highest peak in the Cascades, is the nucleus of the great Mount Rainier National Park. This park receives an annual one and a quarter million visitors.

The northern Cascades contain some of the most superlative mountain scenery of the world and is a great attraction for the hiker and mountain climber seeking the enjoyment of the natural wilderness. The parade of snow-capped peaks standing along the crest of the Cascades form an unmatched scenic backdrop for the largest cities of the Pacific Northwest. The clear mountain lakes, the cold, clear streams, and the man-made reservoirs abound with trout, and offer the fisherman almost unlimited opportunities to enjoy this popular sport. The back country of the mountains provides big game hunting for deer, bear, elk, and mountain goats.

The recreational resources of the central and eastern portions of the State of Washington have been enhanced significantly through the program of the Department's Bureau of Reclamation. In 1960 there were 32 recreational areas on the Columbia Basin, Yakima, and Okanogan Federal reclamation projects. Cumulatively, these areas contain some 159,000 acres of water surface and 111,000 acres of land available for recreation use. The total recent recreation use on these 32 areas amounted to over 2,000,000 visitor-days.

The public use facilities available have been provided by other agencies, such as the Department of the Interior's National Park Service with the exception of the visitor facilities administered by the Bureau of Reclamation at Grand Coulee Dam.

Recreational facilities are substantial and include 52 developed camp grounds containing 835 tent spaces and 100 trailer spaces, 8 organized camps with a capacity for 1,100 campers, 119



Olympic National Park also is a hiker's delight with scenic views of rugged snowcapped mountains, thick rain forests, and active glaciers.

Sailboating is a popular form of outdoor recreation in the Evergreen State which has both ocean waters and man-made reservoir waters to draw the recreation-minded.

cabin or club sites, 1,049 picnic tables, 600 picnic fireplaces, 40 boat-launching ramps, 17 boat docks, 30 swimming beaches, and 138,754 acres of public hunting grounds. Recreationists caught almost 1 5 million game fish and bagged 44,000 wild ducks and 1,500 wild geese in the areas in a recent year.

Areas surrounding these water impoundments furnish excellent upland bird hunting for pheasants, quail, and partridge. The wide open spaces of the plateaus and deserts, the deep canyons, the rolling hills, the forests, and the rugged mountains provide fishing, hunting, hiking, camping, and other varied forms of recreation opportunities.

#### *State Park Program*

The Washington State Parks and Recreation Commission administers nearly 120 State, wayside and marine parks, recreation areas, historical and geologic sites, and water-access areas, comprising more than 74,000 acres.

In 1956, the Commission adopted a 20-year plan for the State parks and a 1961 progress report shows notable accomplishments. Out of a total of 13 new areas recommended, eight have been acquired of which six already are under substantial development.

Studies of visitors to State and national parks have made it clear that the preservation of outstanding recreation resources in parks and recreation areas contribute to the economy of the surrounding region. Commercial enterprises have expanded and new enterprises have been developed adjacent to the parks to meet the needs of the visitors. The travelers' expenditures make it possible for the owners of business establishments to provide jobs, to purchase supplies and materials from farms and factories, and to make profits from which taxes are paid to help finance

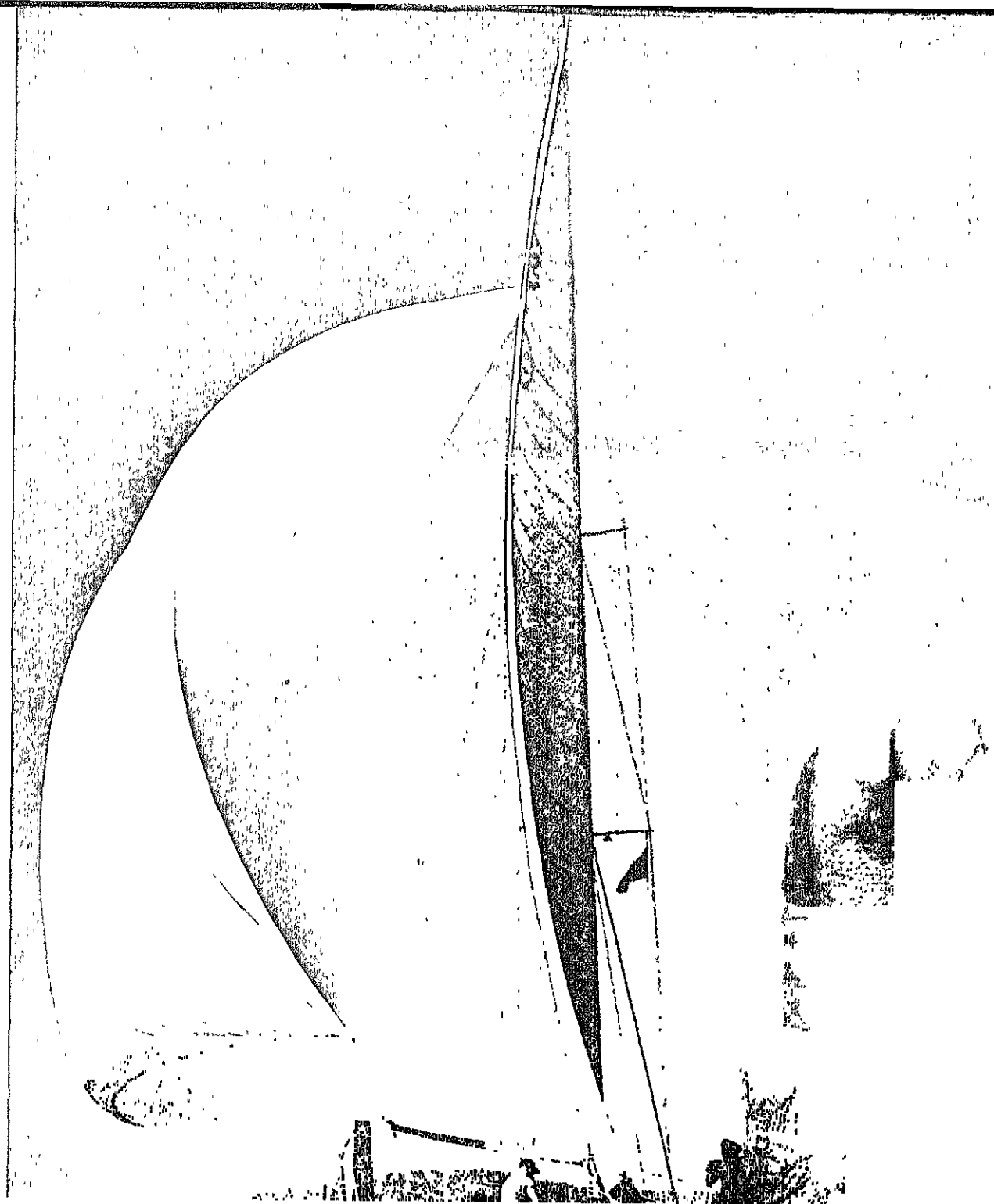
the activities of the local, State and national government.

One of the visitor studies made was a survey of overnight camping in the Washington State Parks, made by the Commission in 1956. Based on monies spent by campers, the survey report concluded that "it is not unrealistic to estimate that the State park visitor alone would bring in between \$40,000,000 and \$50,000,000 in additional tourist revenue each year."

#### *Privately-Owned Recreation Facilities*

Privately owned recreation facilities are of major importance in Washington. These vary from resident summer camps for boys and girls to fine hunting areas. The State's crop and pasture lands contribute significantly to the supply of outdoor recreation opportunities. Many operate as vacation farms, accepting tourists who live at the farm or ranch during their stay. Others lease or supply hunting opportunities, often in combination with cabin facilities. Camping, picnicking, fishing, hiking, horseback riding, and guide services are provided by some. Many lease or sell scenic sites for home and camp lots.

Lists of all the privately operated recreation opportunities in Washington are not available from any single source. Travel bureaus and agencies, commercial organizations such as gasoline companies, motel and hotel associations, airlines and railroads, local chambers of commerce and outdoor clubs and organizations all can supply information on many of the privately owned facilities. Local inquiry will reveal others. Information is available from the Tourist Promotion Division, Department of Commerce and Economic Development General Administration Building, Olympia, Wash.



# Water and Power Resources of Washington

The Columbia River is, of course, one of Washington's greatest natural resources. This mighty river, through its enormous flow and rapid fall, is the greatest power stream in the civilized world. As a source of power, it is mightier than the Mississippi, greater than the Volga. It dwarfs the Ganges, the Euphrates, the Yangtze, the Yukon, and the Amazon in value to man.

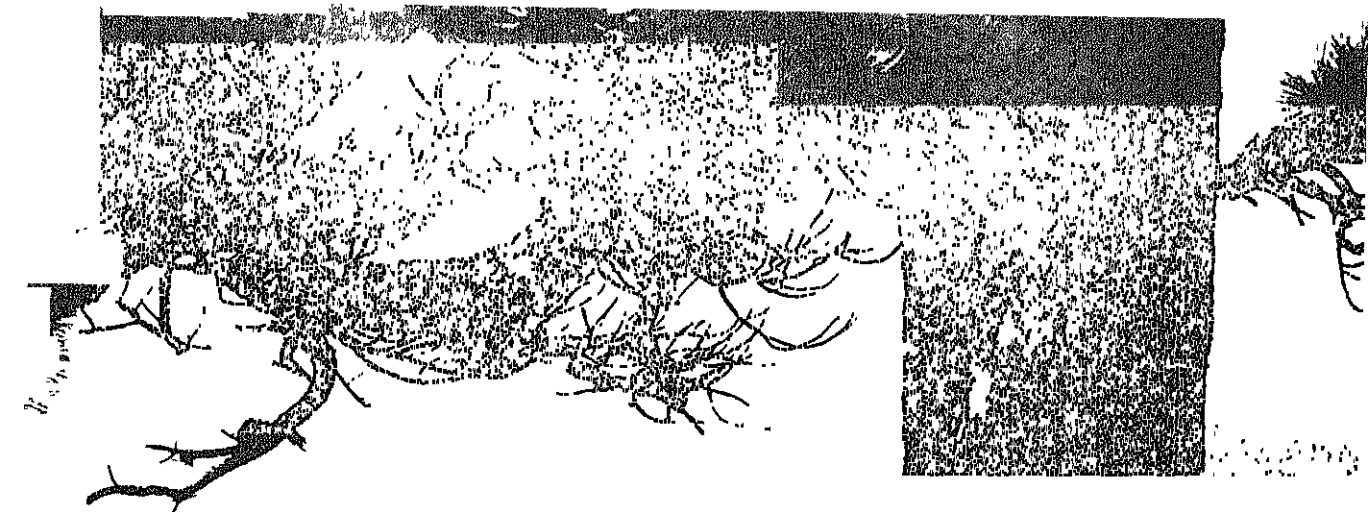
Fully one-third of the hydroelectric potential of the United States lies along the Columbia. Its waters coursing to the ocean mean life and progress to a great region of our country, often called the "Great Inland Empire", and the contribution of the river to America far transcends its immediate benefits to the Pacific Northwest.

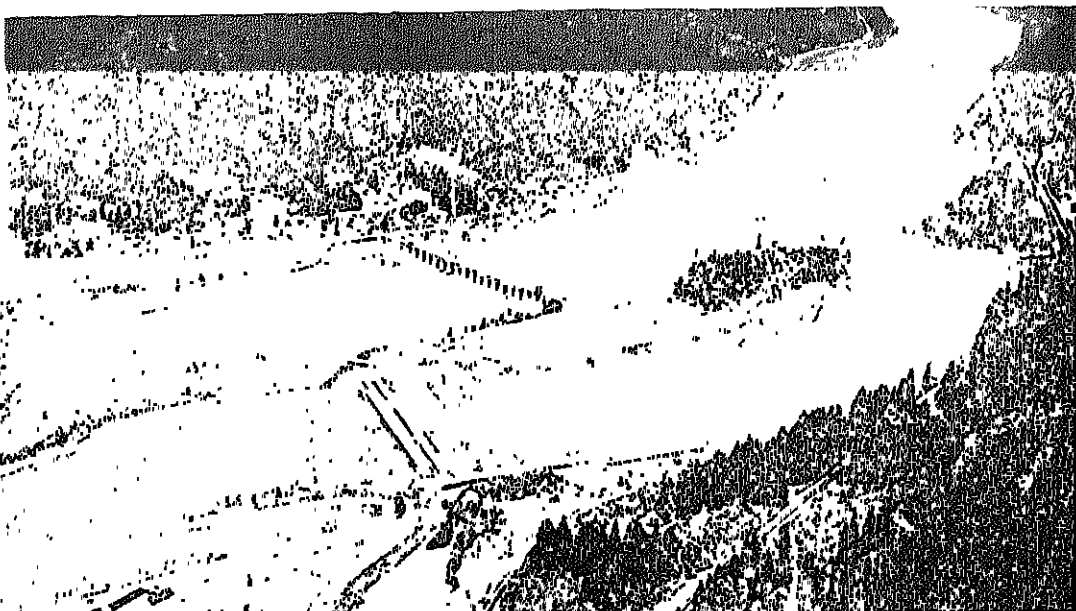
Similarly, the coastal streams and the tributaries of the Columbia are important in any catalog of the State's assets. The benefits derived from the development of this river complex constitute a primary pillar in the economy of Washington not only presently but to an ever increasing extent as industry expands and agriculture diversifies.

The Columbia is navigable by ocean-going vessels to Vancouver and by barges over additional mileage. The largest river flowing into the Pacific Ocean, the river drains an area of 259,000 square miles. The river originates in Columbia Lake, lying between the Canadian Rockies and Selkirk Mountains at an elevation of 2,655 feet. About 60 percent of the water that



door recreation, and fish and wildlife habitat.





Bonneville Dam—constructed by the U.S. Army Corps of Engineers—harnesses the mighty Columbia River 40 miles upstream from Portland, Oreg. Linking Washington and Oregon, Bonneville was the first multipurpose dam on the river.

passes the mighty Grand Coulee Dam, one of the largest concrete structures in the world, originates in Canada

The primary tributaries of the Columbia are the Pend Oreille, Spokane, Okanogan, Methow, Wenatchee, Yakima, Snake, Lewis, and Cowlitz rivers. The Snake, the largest tributary, is navigable for more than 150 miles. The Okanogan, Lewis, Cowlitz, Nooksack, Skagit, Snokomish, Duwamish, Puyallup, and Chehalis rivers are also navigable for lesser distances.

The largest natural lake is Lake Chelan which is located between the eastern ridges of the Cascade Mountains. It is 55 miles long, from one to three miles wide, and more than 1,500 feet deep in many places. Lake Roosevelt, the reservoir impounded by Grand Coulee, is 151 miles long.

In general, the State of Washington is abundantly supplied with high quality ground water, and these supplies are adequate for all foreseeable demands.

#### *Power Resources*

The State of Washington leads the Nation in hydroelectric power and potential hydroelectric development. The State's 49 existing hydro-

electric plants in 1961 had an installed capacity of over 8,000,000 kilowatts and by the mid 1960's will have well over 9,000,000 kilowatts.

Washington's hydroelectric potential is estimated at 25,500,000 kilowatts with ultimate development of 265 hydroelectric plants. This figure is more than double the potential of California, the nearest State in hydro energy. Potential hydroelectric development in the State represents over half of the foreseeable development in the Pacific Northwest.

Currently, there are 27 additional projects under construction or under consideration for construction in the State of Washington which would add an installed capacity of 6,700,000 kilowatts.

Seven completed Columbia River multi-purpose projects, four of them wholly in Washington, have an installed capacity of 4,300,000 kilowatts. Three Federal projects, two wholly in Washington, are under construction and have an ultimate installed capacity of 1,350,000 kilowatts.

The four completed Federal projects entirely in Washington are Grand Coulee, Chief Joseph, Chandler, and Roza, while three projects, Bonneville, McNary, and The Dalles are on the lower Columbia where it forms the boundary





Power from such sites as Alder Dam and Lake, operated by Tacoma City Light, makes the State of Washington lead the Nation in hydroelectric power and potential hydroelectric development.

between Oregon and Washington. Two of the projects under construction, Ice Harbor and Lower Monumental are in Washington, while the third, John Day, is a lower Columbia Project. Power capacity of lower Columbia River boundary projects is divided equally between Washington and Oregon.

Federal water-resource projects in Washington are constructed by the U.S. Army Corps of Engineers and the Department of the Interior's Bureau of Reclamation. Power produced at Federal projects is marketed by the Department's Bonneville Power Administration.

There are 42 existing non-Federal hydroelectric plants in Washington, publicly or privately owned with an installed capacity of 3,722,000. These include the City of Seattle's Ross, Diablo and Gorge plants on the Skagit River; the City of Tacoma's Cushman projects on the north fork of the Skohomish river and Nisqually river plants; the Puget Sound Power and Light Company's Baker, Puyallup, Snoqualmie and White River projects;

The Cowlitz County Public Utility District's and Pacific Power and Light Company's Lewis River projects; Chelan County PUD's Rocky Reach and Rock Island projects on the Columbia and Chelan River Project; Grant County PUD's

Priest Rapids Project on the Columbia; Pend Oreille County PUD's Box Canyon Project on the Pend Oreille River and the Washington Water Power Company's Spokane River projects.

Two major non-Federal projects, the Grant County PUD's Wanapum Project on the Columbia River and the City of Tacoma's Mayfield Project on the Cowlitz River, will add an installed capacity of 951,000 kilowatts.

Following President Kennedy's recommendations, Congress has now authorized construction of the world's largest atomic electric plant (800,000 kw) at Hanford, Wash., by the Washington Public Power Supply System, which will provide new industry-building power equal to that of two major dams at no cost to the Federal Government.

Low cost power from the Columbia River system has had tremendous impact on the industrial economy of the State.

Beginning with the early years of World War II, the aluminum industry in Washington began a phenomenal growth, until by 1945 about 40 percent of the Nation's aluminum was produced in the State of Washington, and during the Korean War about 50 percent. Hydroelectric power not only helped produce much of the aluminum for the planes that helped win World

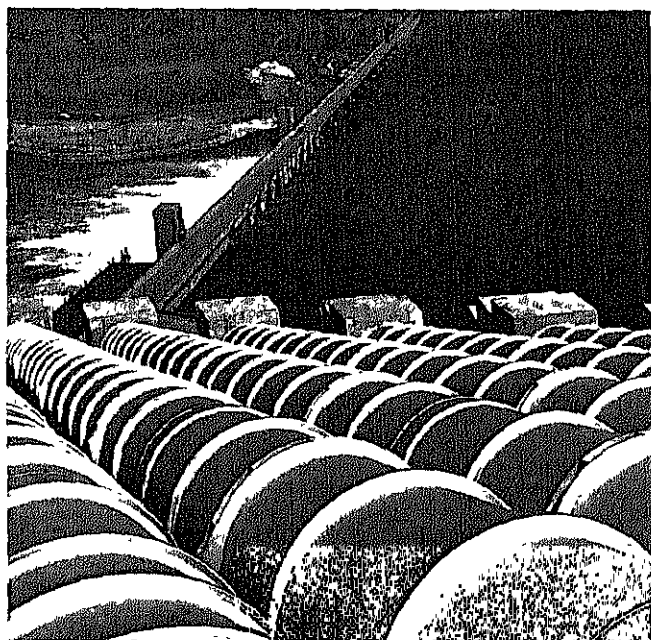
War II, but helped build hundreds of ships and produced countless critical war materials.

Today, the State of Washington accounts for about one-fifth of the Nation's aluminum production capacity and in the last decade has added many large electrometal and electrochemical plants to its industrial pattern. Fabrication of aluminum and metal products as well as local fabrication of wood products has added countless new small industries to the State.

As an example of the contribution of low cost power to the State, the aluminum companies

that are among the lowest in the Nation contributes to an exceptionally high standard of living and a dynamic economy.

Utility leaders in the State and related Federal agencies believe that a continued high level of hydroelectric development must be maintained as a foundation for a sound and balanced economy. Programs to carry this out call for development of all feasible hydroelectric projects in terms of the best utilization of all resources involved to meet the area's rapidly growing power requirements.



(Left) These gigantic steel pipes, also seen on the right, use power produced at Grand Coulee Dam to lift water from the Columbia River for storage in periods of abundance and for use in later dry periods.

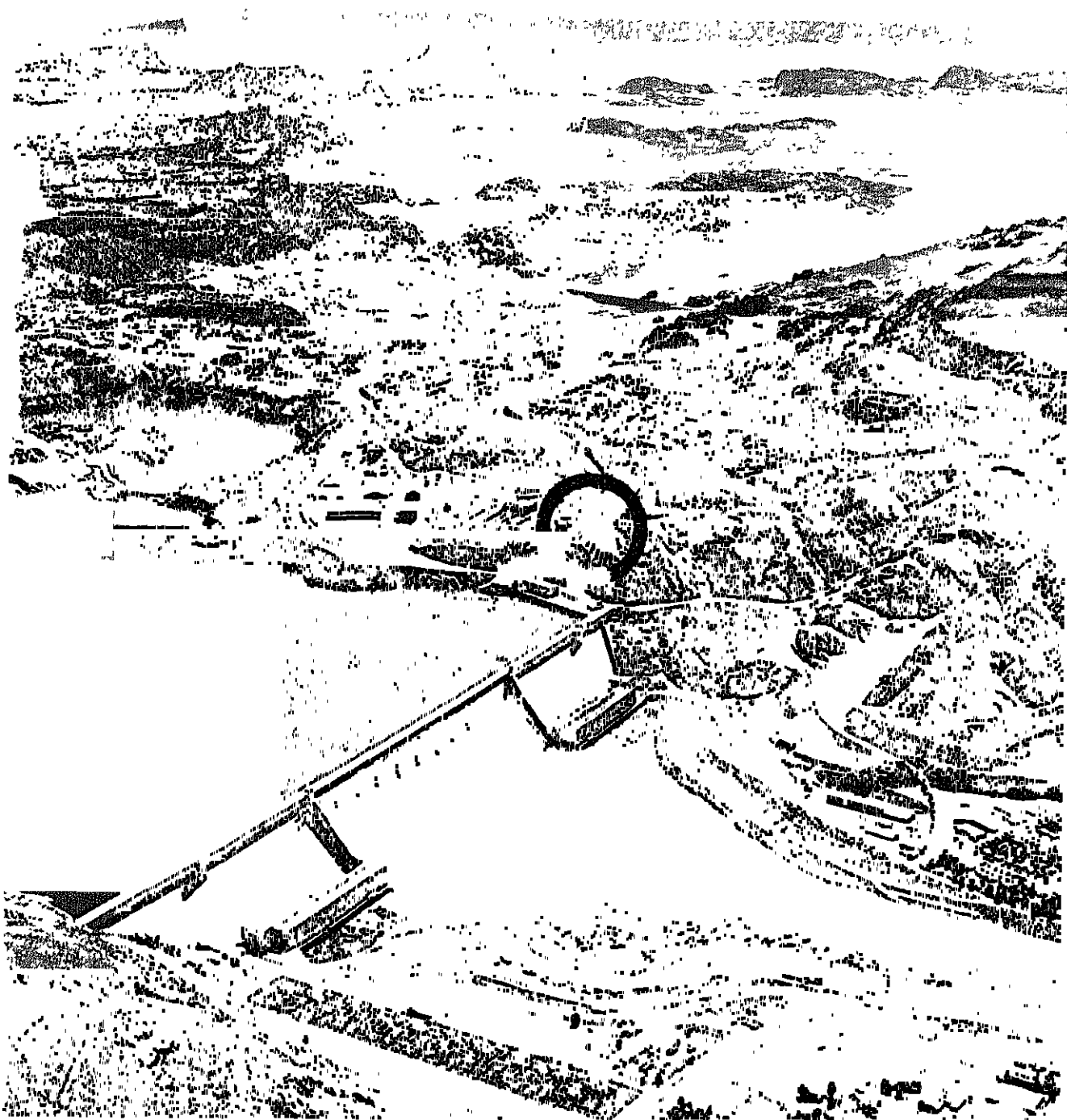
(Right) Grand Coulee Dam, one of the largest concrete structures in the world, is considered one of the engineering marvels of the 20th century. A multi-purpose conservation project, it provides hydroelectric power, flood control and river regulation, water for outdoor recreation and for irrigation. Behind the dam, stands the Grand Coulee, ancient bed of Columbia River, which today acts as the water storage area and the backbone of a complex water distribution system.

alone have a plant investment exceeding \$250,000,000 and a payroll in recent years in excess of \$39,250,000 with nearly 8,000 employees. Local and State taxes paid by these companies approach \$5,000,000 and Northwest purchases of materials, supplies and services are about \$24,000,000.

Largely as the result of its outstanding hydroelectric power development, the State of Washington has the Nation's highest average residential use of electricity, about 9,800 kilowatt-hours a year. This is well over twice the average residential use in the United States. The high use of electricity per family, coupled with rates

One of the most noteworthy efforts in this direction is the greatly accelerated construction and scheduling of new hydroelectric projects by large public and private utilities of the State. The Federal Government on the other hand, is assuming its full responsibility in carrying out the development of the larger multipurpose Columbia River projects.

Wise management of the State's hydroelectric power resources calls for the fullest cooperation between the Federal agencies having to do with power and water resources, all operating utilities of the State, State and local agencies, and ultimately the people themselves.



# Fish and Wildlife Resources of Washington

Washington's geography, its varied topography and its climate contribute to its high rank among the States for sport fishing and hunting and its importance in the field of commercial fishing.

Each year, its waters attract 375,000 licensed sport fishermen, and its game resources attract more than 280,000 hunters. Annually also, its commercial fishery resources—some within its boundaries and some on the high seas—yield landings of commercial fish varying from 115 to 155 million pounds in volume and from \$15 million to \$20 million in value.

There are more than 11,000 commercial fishermen in Washington who operate about 1,500 motor vessels, and more than 2,600 small boats. There are approximately 170 fish processing plants employing nearly 5,000 workers at the peak and an annual average of half that number. Salmon is the principal species taken in the State with halibut in second place. Pacific oysters and Dungeness crabs and other shellfish are also important fisheries.

Among the attractions for sport fishermen, Washington boasts about 8,000 lakes and ponds distributed throughout the State; 50,000 miles

of public rivers including the famed Columbia River and other streams; 1,800 miles of "inside" marine shoreline, such as Puget Sound, Juan de Fuca Strait, and many bays and estuaries and another 175 miles of coastline on the open ocean.

To the commercial fisherman, it offers the Washington portion of the Columbia River System, the waters of Puget Sound with its salmon, groundfish, and shellfisheries; offshore fisheries and shell fisheries and such deep sea resources as the halibut, salmon and groundfish fisheries which attract many of the motor vessels operating out of Washington ports.

Rainbow and steelhead trout, Chinook and silver salmon, brook trout, cutthroat trout and kokanee are the more important sport fish. Dolly Varden, brown trout, pink salmon, sole and flounders, surf perches and surf smelt, bass, sturgeon, sunfish and numerous other species are also caught by the sport fisherman.

Access to some fishing areas is a problem but the Washington Department of Game controls 210 miles of stream bank on 45 rivers. It has also aided the sport fisherman by maintaining approximately 75 vehicle parking areas and 50 boat launching sites. The State has also

required nearly 300 lake access areas on more than 250 lakes. The reservoirs of Department reclamation projects in Washington have public shorelines.

To the hunter Washington offers a land which runs the gamut from sea level marsh areas to forested mountains and prairies.

Salt marshes along the shoreline and numerous other wetland areas offer some of the best migratory waterfowl hunting in the country. The cultivated fields in eastern Washington provide Chinese pheasant, quail and Hungarian partridges. The game animals include deer, elk, mountain goat, bear, blue grouse, ruffed grouse, mourning doves and band-tailed pigeons.


The Department of Game maintains eight big game ranges and ten waterfowl management areas. The largest of these is Colockum Game Range, 99,854 acres, in Kittitas and Chelan Counties, Oak Creek in Yakima County contains 64,322 acres, the Equalizing Reservoir on the Columbia River Basin in Grant and Douglas Counties and the Potholes in Grant County each exceed 40,000 acres.

Five long-range wildlife research projects, presently in operation dealing with Roosevelt elk, Rocky Mountain elk, mule deer, mountain goats, waterfowl and upland game, will add value to the important resources. Since 1952 a habitat program has been carried on in the eastern part of the State to improve conditions for pheasants, chukais, and quail with major emphasis on plantings of trees and shrubs and construction of watering devices.

Principal activities carried out under the fishery improvement are lake rehabilitation and screening of lake outlets. Washington is fortunate in having many fertile lakes in the eastern part of the State. These lakes are stocked with fingerlings in the fall and these grow to catchable size by the next season.

The successful artificial propagation and stocking of winter-run steelhead by the State game department promises continued expansion and increasing popularity of this fishery.

Possibly the largest area of potential fishery development is provided by numerous lakes contained in the Cascade Mountain Range, included principally in National Forest Areas. Many of these lakes at present are inaccessible




or accessible only with difficulty over mountain trails. It is anticipated that as these mountain lakes are made more accessible, they will support a larger trout fishery. Modern fishery management of the more accessible lowland lakes—including rehabilitation and restocking with rainbow trout—provides improved recreational trout fishing areas each year.

Stream clearance and improved fish passage facilities under both State and Federal programs are maintained, and in many cases improve conditions for natural production of fish. The open coastal area and other marine shorelines also offer opportunity for the development of latent sport fisheries.

There are various species of fish known to be present off the coast of Washington which offer considerable commercial potential. These potential resources include such species as pomfret, jack mackerel, squid, saury and possibly other species. Albacore tuna are presently fished off the coast of Washington, but even this comparatively new fishery is now sporadic. The occurrence of this species from year to year is unpredictable because of the lack of knowledge concerning it.

With the completion of shrimp explorations off the Washington coast programs are now devoted to obtaining information concerning the potential resources listed above.



# Mineral Resources of Washington

The mineral resources of Washington are as varied as the rocks and geologic history of the State. They include metallic minerals, mineral fuels, and industrial rocks and minerals. Washington ranks about 35th among the States in value of mineral production.

The more important commodities are sand and gravel, portland cement, construction stone, zinc, lead, uranium, magnesite, gold, silver, and copper. Also present are minerals of manganese, molybdenum, chromium, mercury, nickel, tin, platinum, beryllium, and strontium. Graphite, pumice, sulfur, clay minerals, feldspar, mica, quartz, and fluor spar are also found.

Glacial and fluvial deposits of sand and gravel are wide-spread in the State. Basalt, limestone, dolomite, and sandstone are quarried and used principally for crushed stone. Granite, limestone, and dolomite suitable for dimension stone are quarried at several localities.

Cement is produced mostly in the northern part of the State where large deposits of high-quality limestone and clay are found.

Important concentrations of metallic minerals are present in the mountainous parts of the State. Deposits are found in a variety of forms such as veins, replacement bodies, residual enrichments, and placers.

Deposits of lignite, subbituminous, bituminous, and anthracite coal are worked in several small sedimentary basins in the Puget Sound Trough and on the eastern slope of the Cascade

Mountains. Some of these deposits were extensively mined until the middle of the present century. Some higher-rank coal is of interest as a source of metallurgical coke. The State's resources of coal are estimated at about 64 billion tons, and about 250,000 tons are mined annually.

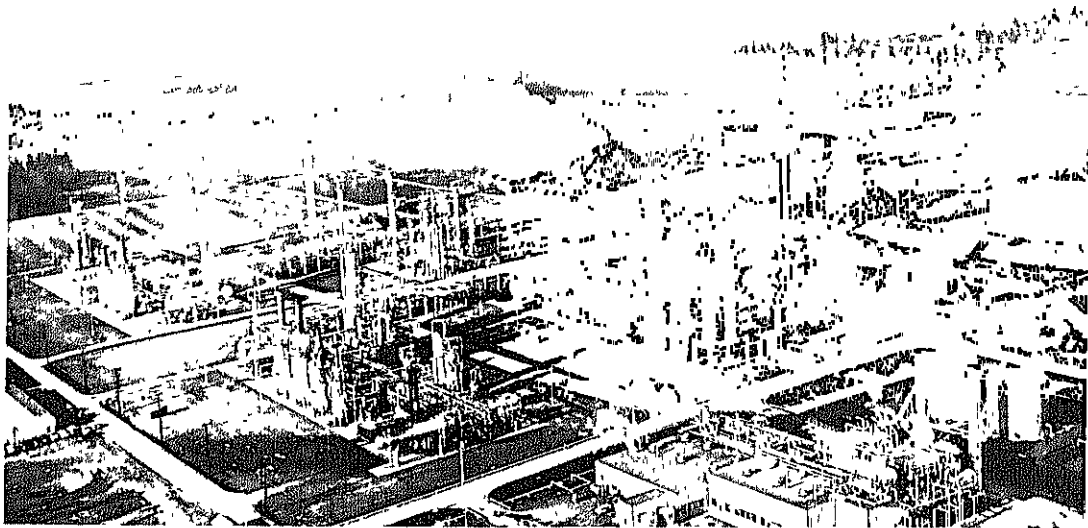
There has been recurring interest in petroleum and natural gas exploration in Washington since about 1900, but no major oil or gas fields have been discovered. Principal exploration interest in recent years has been in the coastal counties of the State, such as in Grays Harbor County, where a number of oil- and gas-bearing rock strata have been discovered by drilling.

Other mineral occurrences are scattered through the State. Some deposits are being actively worked, some have potential value, and some, under present conditions, are of only scientific interest. These include diatomite, peat, glass sand, olivine, bentonite, gypsum and bauxite.

## *Mineral Industries*

Washington's principal mineral products in order of value are sand and gravel, cement, stone, lead and zinc, and coal. Total value of all mineral products in the State is roughly \$70 million annually and has been climbing slowly but steadily for several years.





Washington refines and distributes great quantities of crude petroleum shipped in from other States in modern refineries such as the Texaco complex in Anacortes.

Although Washington ranks well down the list of mineral producing States, its mineral industry is important to its economy. One or more of the State's principal minerals is found in commercial quantities in 37 of its 39 counties. The mining and mineral processing industries employ nearly 30,000 people throughout the State, and pay close to \$200 million in wages each year.

#### *Sand and Gravel*

Sand and gravel production—an important industry in 36 counties—has increased steadily in recent years, partly as a result of the State's progressive highway construction and maintenance program. Six counties—Walla Walla, Grant, Pierce, Snohomish, King, and Spokane—have reported yearly outputs valued at over \$1 million. In addition to highway and other construction uses, large quantities of sand and gravel are used as fill material at dam-building sites.

#### *Stone*

Washington produces some \$16 million a year in stone, principally of the following varieties:

*Weathered quartzite*—used in glass making;

*Basalt*—for concrete aggregate, roadstone, and ballast,

*Limestone*—agricultural use, cement and paper manufacture, and metallurgical processes;

*Marble*—terrazzo chips and agricultural uses;

*Granite*—roadstone, roofing rock, and poultry grit;

*Sandstone*—building facings, flagging, cement, and ferroalloy manufacture

Washington also has substantial production of talc, soapstone, and vermiculite. Stone was quarried in 34 of 39 counties of the State, with production in excess of \$1 million.

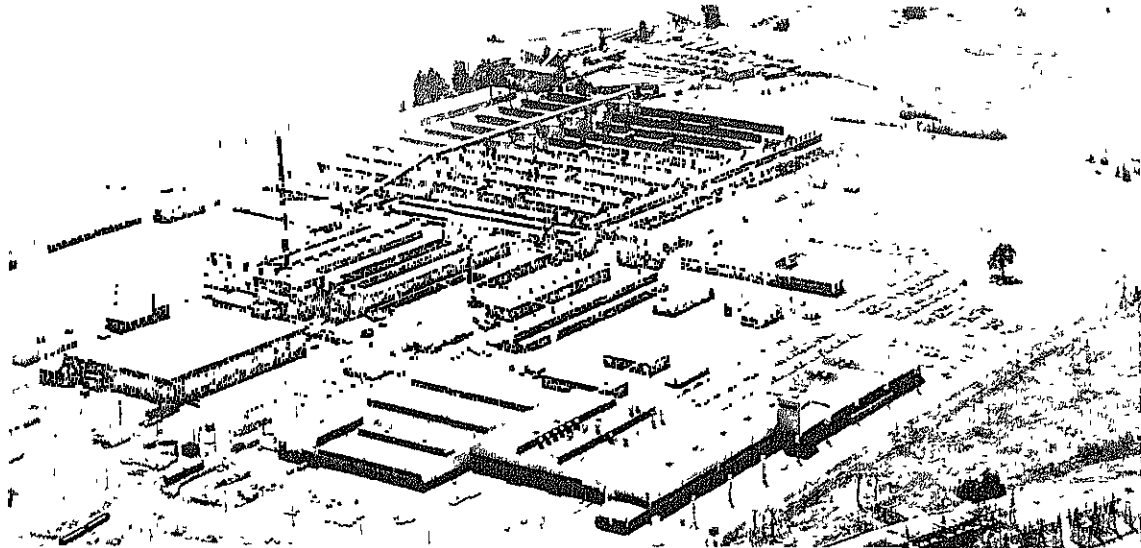
#### *Metals*

There are many small mining operations throughout Washington. However, six mines in four counties account for nearly all the State's metal production. Lead and zinc produced at the Pend Oreille and Grand View mines yield over 99 percent of the total lead production and are also major zinc producers, and the major source of uranium is the Midnite mine in Stevens County. Gold and silver come chiefly from Knobbill in Ferry County and Gold King in Chelan County.

#### *Fuels*

Most of Washington's bituminous coal output comes from nine underground mines and two





Washington's aluminum industry, third largest employing industry in the State, emphasizes smelting and casting of ingots as is done at this Alcoa plant in Vancouver.

strip operations in King, Kittitas, Lewis, and Thurston counties. The State also produces some peat which is sold almost entirely for gardening and agriculture use. New markets are expected to develop for Washington coals, among them shipment of coking-coal to Japan, and the supply of substantial tonnages to the Hanford (Wash.) plant of the Atomic Energy Commission, and to various proposed electric steam-generating plants.

Petroleum and natural gas have been recovered from wells in the Ocean City area of Grays Harbor County and several wells nearby have been tested in short production runs.

#### *Other Mineral Products*

Portland and masonry cement are produced in Washington. About nine-tenths of the output is consumed within the State, the remainder going chiefly to Idaho, Oregon, and Alaska. Barite, diatomite, heavy clay, fire clay, gypsite, and pumice, also are mined.

Iron ore from Stevens County has been used in making cement rather than in blast furnaces or steel mills. However, large deposits of iron ore in Okanogan and Ferry counties could provide a basis for an iron smelting industry that could also utilize Washington's coking-coal resources.

#### *Mineral Processing Industries*

Even more important to the economy of Washington than the mineral-extractive industries are those that process or refine minerals. They refine and distribute great quantities of crude petroleum shipped from California and other areas. Metals are smelted, refined, cast, forged, or extruded. Industrial chemicals of mineral origin, such as uranium compounds, also are processed.

Production and processing of primary aluminum for shipment to fabricators is the State's third largest employing industry exceeded only by construction and aircraft (including missile) manufacture. Washington's aluminum industry emphasizes smelting and casting of high-purity ingots, which permit more forming by extrusion. Such metal also is a source of aluminum wire, now in growing demand for electrical applications. The State's iron and steel industry is based primarily upon electric-furnace operations which employ scrap metal as their principal raw material.

Washington also has a growing ferroalloy industry which produces pure silicon, ferro-silicon, and ferrochromium.

Development of Washington mineral resources is becoming more rapid as additional information concerning them is obtained and made available.

# Land Resources of Washington

The land resources of Washington are diversified by the varied geography and precipitation. Where precipitation is high, there are abundant stands of timber. These are mainly mountainous areas, where much of the land is in National Forests and where lumbering is organized as a permanent industry.

Irrigation districts in eastern Washington—particularly the Columbia Basin—provide highly fertile land for agriculture. Diversified nonirrigated crop production is also conducted in areas where rainfall is barely adequate. Mechanized dry farming is the prevailing land use on the Columbia Plateau.

Where little or no water is available, land resources are predominantly range resources—for grazing cattle and sheep. There are also range resources in rougher parts of the State—particularly on eastern slopes of the Cascades—where rainfall is low and tree growth is scanty.

## *A Major Washington Asset—Its Forests*

While Washington has tremendous basic resources in fish, water power, agricultural land, and minerals, one of the dominant natural



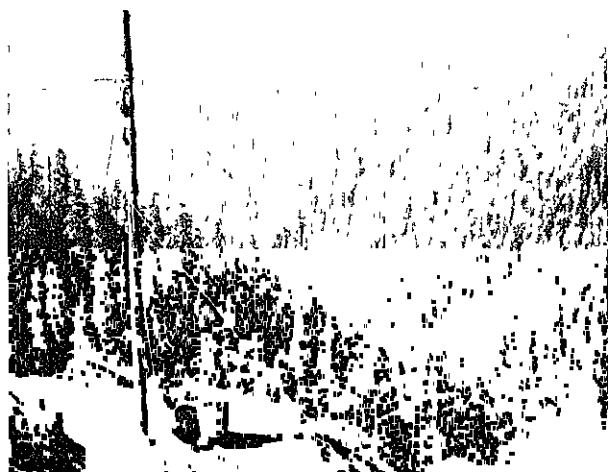


(Top left) Water—stored through Bureau of Reclamation projects in Washington—has converted useless land, or land suited only for dry farming, into rich agricultural areas with high value, diversified crops.

(Bottom left) A farmer bags onions on his farm near Winchester, Wash. On more than a million acres of land in the State, diversified, nonsurplus farming is made possible by irrigation with water from Federal water resource projects.

(Above) Sheep graze on a hillside above irrigated lands in the southeastern part of Washington. Sheep raising is important in the Columbia River Basin.

(Right) The forests resources of Washington are managed on a sustained-yield basis by government and industry to assure an adequate supply for future generations.



resources of the State is its forest lands. Of the 43 million acres of land within the State's boundaries, almost 24 million are classified as commercial forest lands.

Ownership of Washington's commercial forest lands is about equally divided between private industry and the Federal Government. Most of the acreage under governmental control is administered by the Forest Service of the U.S. Department of Agriculture. State, Indian, and public domain lands make up the remainder. Private forest land is held by an estimated 48,000 persons, about half of this land is in tracts under 5,000 acres.

The Forest Service cooperates with Washington in protecting and managing 12,237,000 acres of State and private forests. These forests to-

and has three nurseries producing forest tree seedlings. The Forest Service also administers two research centers in Washington.

### *Forests of Washington*

There are two distinct forest regions in the Evergreen State—the Douglas fir forest west of the Cascade Mountains and the western pine east of the Cascade summit.

The Douglas fir forest covers almost 11 million acres; the Western Pine forest, 8.5 million acres. Intermixed with the fir are other important kinds of timber such as western hemlock—the State tree—western red cedar, Sitka spruce, and several other species of fir.

In the pine forest, we find ponderosa pine, Douglas fir, spruce, larch, white fir, and lodgepole pine.

### *Washington's Timber Harvest*

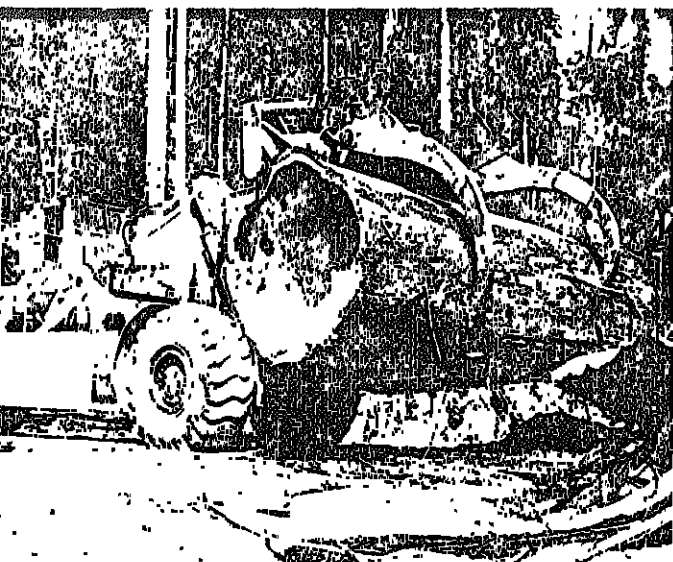
One-sixth of the Nation's standing timber is to be found in the commercial forests of the State with an estimated volume of 315 billion board feet. This ranks second only to Oregon in the Nation.

In recent years, Washington's timber harvest totaled approximately 4 billion board feet annually with about 63 percent of the total cut from private lands. It has been estimated that about 350,000 acres of trees are cut in Washington annually. Washington's forest-growing stock—trees 5 inches or over at breast height—totals more than 65 million cubic feet of wood, about 13 percent of the Nation's forest growing stock.

Washington ranks third in the Nation in the production of lumber from its annual tree cuttings with about 3.2 billion board feet per year produced by about 1,000 saw mills.

### *Economic Importance of Forestry*

The State's lumber industry provides full-time jobs for an average of 42,500 persons per year with an annual payroll totalling over \$130 million. All forest industries—including plywood, pulp, and assorted wood and forest products—employ well over 60,000 people



Washington produces 5 percent of the world's timber.

gether with the seven National Forests administered by the Forest Service are a major source of income.

The National Forests are managed for the multiple-use and sustained yield of all their renewable natural resources—timber, water, range, wildlife, and recreation. Technical and financial aid is provided through the State forester who administers the cooperative programs. Washington employs foresters to assist private landowners in managing forests,

annually. This represents one-third of all persons employed in manufacturing in the State and means a \$300 million payroll per year.

Washington leads all States in wood pulp manufacturing, and its industries also include Christmas trees.

Recently, wood pulp output in Washington was 11.5 percent of the Nation's total, or about 2.5 million tons, employing a force of nearly 18,000 people. This also represents 5 percent of the world output of this product.

This large consumption of forest products for pulp also includes the use of mill leftovers, prelogged and salvaged wood—utilizing a billion board feet of these materials which otherwise would have little value or use.

### *Reforestation and Tree Farm Program*

Organized and carefully planned conservation action to perpetuate Washington's valuable forest resource started about 50 years ago. Using modern tree-farming methods which include harvesting to provide natural regeneration, forest managers are helping nature do a better job of reforesting. On areas denuded by repeated fires, land cleaning, or other causes, the forest manager is reforesting by seeding and planting.

Located within the State are six large tree nurseries with a combined production of 35 to 40 million trees per year. In all, more than 400,000 acres in Washington have been reforested to date by planting or direct seeding with about two-fifths of the reforestation taking place on private land.

### *Washington's Forest Facts*

Total land area (acres) . . . . .	42, 743, 000
Total forest area (acres) . . . . .	23, 868, 000
Percent forest . . . . .	55.8
Commercial forest land (acres) . . . . .	19, 490, 000
Noncommercial forest land (acres) . . . . .	4, 378, 000
Volume of sawtimber in commercial forest (bd. ft.) . . . . .	315, 967, 000, 000, 000

### *Range Resources*

Livestock farms and ranches are scattered extensively along the eastern base of the Cascade Mountains and in the highlands, of the



Lumbering is one of the Evergreen State's major industries, employing over 60,000 people.

Okanogan, Snake, Yakima, and Spokane Valleys of the State of Washington.

In the river valleys, there is yearlong range. Except for these areas, the western part of the State is mostly ungrazed forest land. Rangelands in the eastern part of the State are used primarily for summer range, with some areas providing spring-summer-fall range.

Following are types of acreages used predominantly as range resources:

<i>a. Lands in private ownership:</i>		<i>Acres</i>
Farm croplands used for pasture . . . . .	621, 000	
Farmlands used for pasture . . . . .	2, 888, 000	
Other farmlands, brushlands, etc. used for pasture . . . . .	5, 726, 000	
<i>b. Lands in State ownership:</i>		
Total acreage suitable for pasture . . . . .	1, 197, 000	
Of which total, 475,000 acres are leased by the State for grazing.		
<i>c. Lands in Federal ownership:</i>		
Area covered by grazing leases, under Bureau of Land Management, Department of the Interior . . . . .	273, 000	
Area covered by grazing permits, under Forest Service, Department of Agriculture . . . . .	400, 000	
Total . . . . .	11, 105, 000	

# Cities of Washington

(Below) The downtown section of Spokane, Wash., as viewed from the south. Spokane is an important lumber and agricultural center and also makes significant contribution in processing the mineral and metal resources of the State.

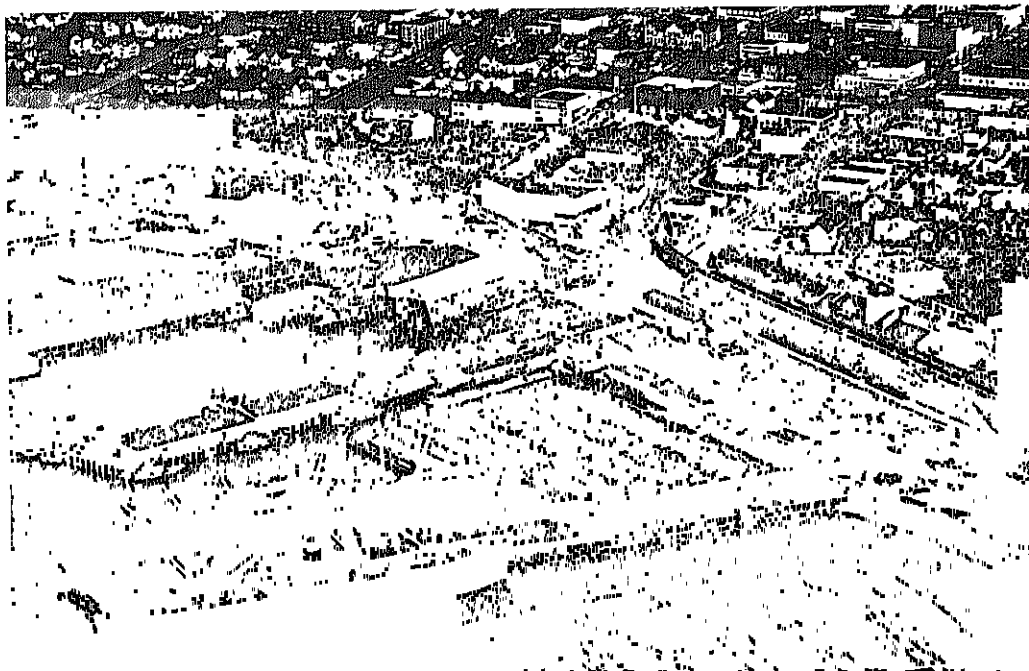
(Above) Olympia, capital of the State, contains important lumber processing industries and canning facilities.

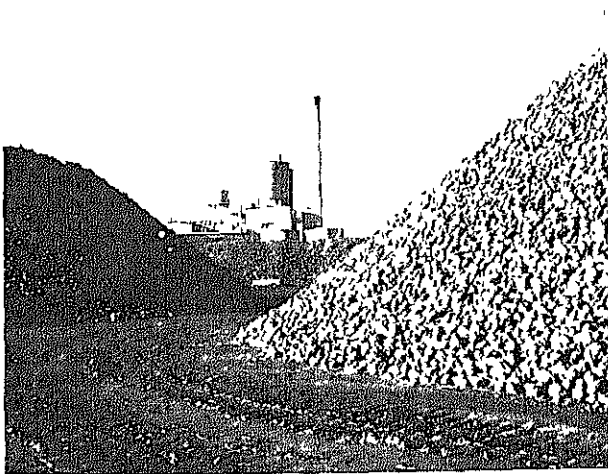
(Right) Yakima, located in south-central Washington, is a major agricultural processing center. Other major activities range from processing of lumber products to brickmaking.



One of the principal cities of the West, Seattle is a thriving commercial center and an important gateway to the Pacific.

Everett, one of Washington's major cities, is an important lumbering center.





The Utah and Idaho sugarbeet plant, located east of Moses Lake, is framed by two large stockpiles of Columbia Basin sugarbeets. The \$7 million plant employs 300 people and is capable of processing 25,000 acres of sugarbeets.

Ship loading lumber in Tacoma harbor, Puget Sound, Wash. Manufacture of forest-products is one of the principal industries of this major North Pacific Coast port and industrial center.



About 700 grazing leases and permits (issued by the Federal Government) are currently in force, and will continue until transfer of land title or other status or classification changes require their termination.

Total livestock population grazing on pastures and rangelands of Washington:

Cattle	1,537,000
Sheep	303,000
Horses	92,000
Mules	3,000

Cattle raising and grazing is generally confined to the eastern part of the State. Sheep production is concentrated in the southeastern part of Washington.

### *Agricultural Resources of Washington*

Washington has 51,577 farms covering 18.7 million acres of land—or 43.8 percent of the State's land area. These farms average nearly 363 acres in size and have an average value, in terms of land and buildings, of \$44,071 or \$148.70 per acre.

The State's farms have about 7.9 million acres in cropland, more than 6.1 million acres in pasture land, and about 3.9 million acres in woodland also pastured. More than a million acres of farm land in Washington are irrigated, principally with water from Federal water resource projects. In a recent year, Washington farmers and ranchers realized a gross farm income of nearly \$638 million, and a net income of slightly less than \$210 million.

Washington farmers and ranchers are important customers of business, industry, and service trades—not only in Washington but throughout the Nation as well. In the latest year of record, they had production expenses of \$430.4 million, including \$66.8 million for repair and maintenance of buildings, repairs and operation of motor vehicles and other machinery, and for petroleum products. They also spent \$73.5 million for feed and \$17.5 million for lime and fertilizer.

Sales of farm commodities in Washington totaled more than \$574 million annually, of which 63.1 percent came from crops and 36.9 percent from livestock. Wheat accounted for



23.8 percent of cash receipts, milk for 13.3 percent, cattle and calves 11.3 percent, and apples 8.3 percent. Apples and wheat are important shipments to the ports of Seattle, Tacoma, and Vancouver.

In terms of projects of the Department's Bureau of Reclamation, Washington ranks third in cash returns on irrigated lands, exceeded only by California and Idaho. Of the four Bureau of Reclamation projects in Washington—Chief Joseph, Columbia Basin, Okanogan, and Yakima—the value of crop yields per acre is about \$170.49 or higher than the average crop value per acre in the State. The value of crops per acre on Reclamation projects in Washington ranks about fifth among the seventeen reclamation States.

In Washington, there are 77 locally organized and managed soil conservation districts that include 40.4 million acres and have 33,779 cooperators operating 11,935,402 acres. Eleven watershed protection and flood prevention projects have been authorized for planning, including six authorized for operations.

Washington ranks third in the Nation in the production of lumber from its annual tree cuttings.



Washington is famous for the wine colored Yakima apples grown in the Tieton Valley. These Jonathan apples are noted for their quality in flavor and size.

## Principal Farm Products of Washington

Cattle and calves	Black walnuts
Corn	English walnuts
Sorghum	Apples
Winter wheat	Apricots
Spring wheat	Cherries
Oats	Grapes
Barley	Nectarines
Rye	Peaches
Field beans	Pears
Field peas	Plums
Hay crops	Prunes
Field seed crops	Sugar beets
Hops	Table vegetables
Irish potatoes	Berries
Lentils	Almonds
Mint for oil	Hazelnuts
Root feed crops	

The agricultural potential of the State of Washington is considerable, but to make the provision of irrigation water economically feasible for the remaining undeveloped or dry-farmed lands, low-cost hydroelectric power production has to be an integral part of the Department of the Interior planning. Such power is necessary to pump the Columbia Basin's bountiful water supply from the river gorges uphill to the land to be irrigated.

Forest lands, such as these on the Colville Indian Reservation, are one of the major natural resources in the Evergreen State, comprising 55.8 percent of the total land area in the State

## Indians of Washington



In the region of central Idaho and the eastern sections of Washington and Oregon there ranged at one time a large number of Indian tribes, formerly very populous (particularly those along the coast) and now known collectively as the Shahaptian.

These included, among others, the Nez Perce (most easterly group centering in Idaho and the Snake River area where Idaho, Oregon and Washington join); the Palouse, the Walla Walla, the Yakima (most westerly group living on Yakima River west of the Columbia), and the Colville.

Migration of the Washington Indians applied almost entirely to the interior people, after the non-Indians came, the Indians resisted movement eastward in the face of the invasion and it was impossible for them to move westward.

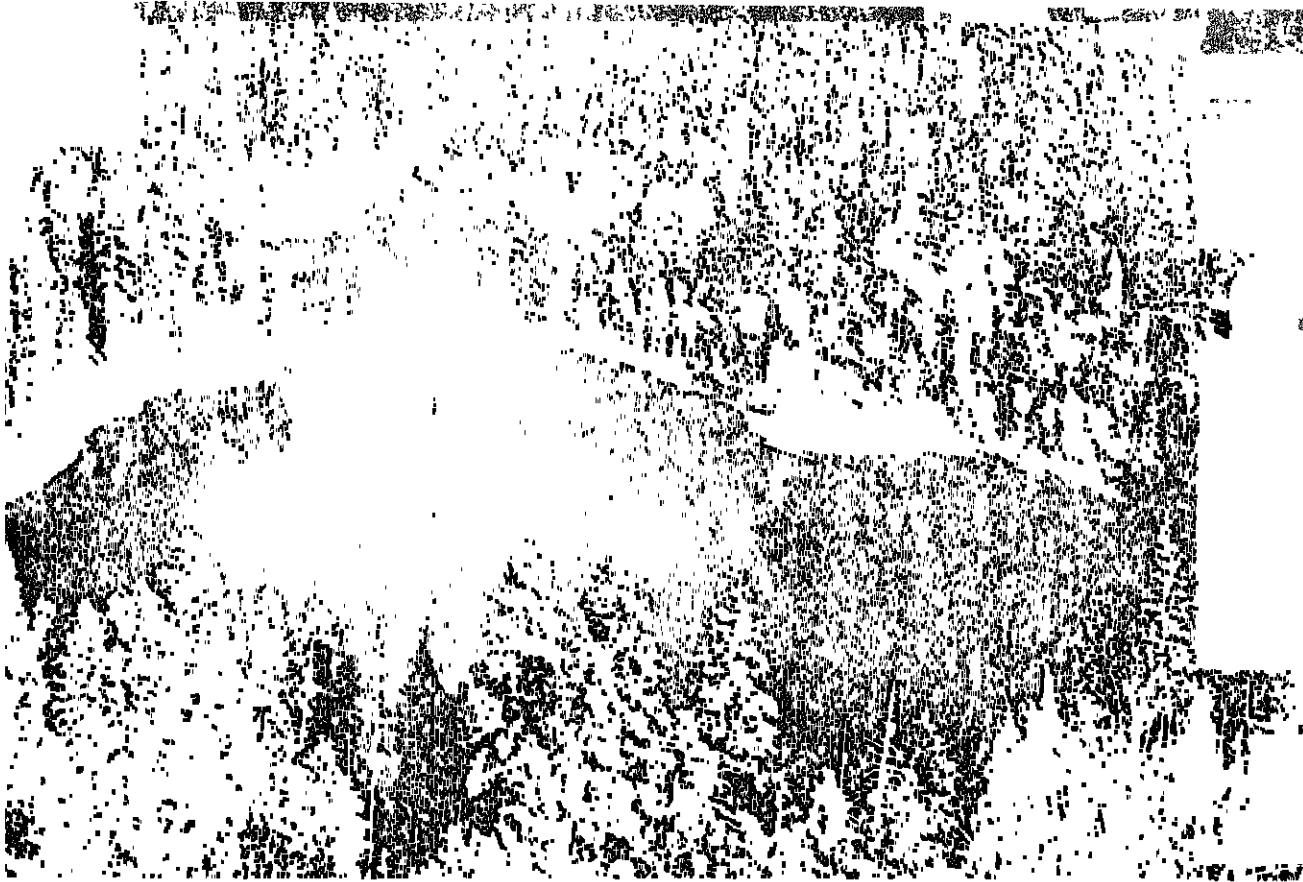
These were primarily river people, subsisting mainly on fish, such as salmon, on camas bulbs, and on roots.

In the early 1700's, horses were introduced among the tribes of the tri-State region and they became highly skilled horsemen, acquiring great

numbers of the animals and counting wealth. By the 1800's the Nez Perce identified with a breed developed in the the Appaloosa horse, whose name came from the Palouse Tribe. South of the Yakima the Cayuse Tribe were widely known as horse dealers and their tribal name was prominently known among Oregonians as a synonym for "horse"

With the coming of the horse, the eastern tribes began to undergo cultural changes. Although fishing remained an important part in their subsistence, they also became hunters, particularly of the buffalo. They took over the patterns of the horsemen of the interior area, using the fringed skin clothing, feathered bonnets of those tribes and dress and clothing and other articles with beaded decorations.

The Washington tribes, like their relatives in Idaho and Oregon, stepped squarely out upon the stage of history with the descent of the Columbia by Lewis and Clark in 1805-06. But in the latter part of the century the traders of the Hudson's Bay and N



Companies made their appearance, and the outposts of these organizations—particularly those of the Hudson's Bay Company—left distinguishable marks on the Indian tribes and their destinies.

Company outposts often became Indian Service headquarters for newly established reservations, and in some instances an Indian tribe would become known by the name of the post. Such was the case of the Colville Indians: their name is derived from Fort Colville, a post of the Hudson's Bay Company at Kettle Falls.

The Spokane was a more scattered group than the Colville; Spokane is a phonetic derivation of their native name, thought to signify "Sun People." When their reservation was established in 1881 it was placed under the Colville Agency and remains so today. Some of their number were placed on the Flathead Reservation in Montana, and in more recent years some have settled on the Coeur d'Alene Reservation in Idaho and some on the Colville Reservation.

The Nez Perce, one of the tribes to participate

in the treaty signed at Walla Walla in 1855, reserved for themselves their ancient home in the Wallowa Valley at the crossroads of the Oregon-Washington-Idaho boundaries. The Nez Perce refrained from taking part in the conflicts that followed the signing of that treaty, but subsequent events led them, too, into open hostilities with Federal troops.

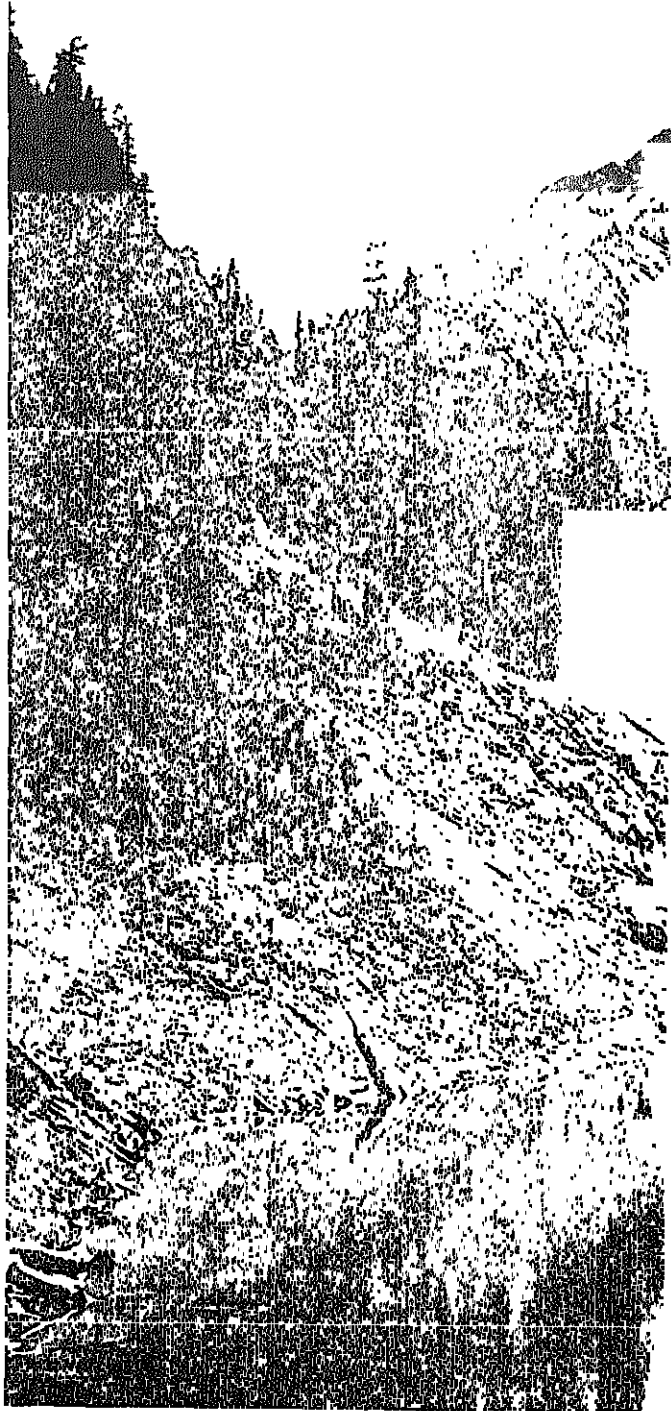
Under the leadership of the famed Chief Joseph, the tribe managed to escape virtually to the border of Canada, over 1,000 miles through the mountains, encumbered by women, children and elderly members of the band and with little more than 100 effective fighting warriors. Joseph led his people through the Bitter Root Mountains, twice across the Rockies, through what is now Yellowstone National Park, across the Missouri River, to Bear Paw Mountains to within 30 miles of the Canadian line. There he surrendered, and there delivered what is probably the most quoted Indian oration: "Hear me, my chiefs. I have fought, but from where the sun now stands, Joseph will fight no more forever."

# Geologic History

The State of Washington was once the site of a large sea bordered on the east by continental lands and on the west by a chain of volcanic islands. Over many millions of years, thick deposits of layered rocks formed on the floor of this sea; much of the rock was lava and ash poured out by submarine volcanoes; part was sediment washed down from adjacent land masses. Eventually a series of mountain-building movements raised, folded and fractured the rocks. Mountain building continued over a long period, and several pulsations occurred at different times.

This sea was not the only one that covered Washington, nor was this the only time that mountain building occurred there. Sedimentary rocks that crop out in eastern Washington were laid in a sea so ancient that evidence of fossil life is rare and primitive. Parts of northern and eastern Washington show traces in the rocks of the building of several earlier mountain ranges.

Other major geologic events occurred in Washington. About 25 million years ago, the





of the Columbia Plateau were formed by a vast outpouring of very fluid lava that completely buried a hilly countryside. Because of later uplift and erosion deep canyons were carved, in the walls of which one can see these old lava flows. About one million years ago the great volcanoes that now tower above the Cascade Range started the series of eruptions that built them to their present height. About this time, also, continental glaciers spread from Canada over most of northwestern and northern Washington, and smaller valley glaciers poured down valleys and canyons from the Cascade and Olympic Mountains. These glaciers melted so short a time ago that traces such as moraines, lakes, and glacial scratches on rock are still abundant.

Geologically—as well as scenically—Washington can be divided into seven natural regions. The divisions are based on differences in present physiography, which, in turn, are consequent on differences in rock types and in geologic history. Present climatic variations and geographic position modify these large-scale earth features into landscapes of endless variety.

In geologic terms, Washington's landforms are transitory features. The slow processes of erosion and deposition, downwarp and uplift are constantly modifying and changing present landscapes. Many traces of even such recent geologic events as the great glaciation have been obliterated or obscured by these processes.

Consequently, in scattered parts of Washington's eastern and northern mountains, the imprint of events that occurred more than a billion years ago is still decipherable in the rocks. From scattered evidence contained in the rocks, a description of the geologic past of Washington has been pieced together. This history covers more than a billion years, stretching from Precambrian times to the present day. Many of the important events in the geologic history such as deposition of great thicknesses of sedimentary rocks, emplacement of the great batholith, outpourings of vast amounts of volcanic rocks, and deformation of the rocks occurred within the last 150 million years.

From west to east the physiographic divisions are

*The Olympic Mountains*—a high mountainous

area of great scenic beauty, composed of sedimentary and volcanic rocks steeply dipping and contorted. The sedimentary rocks are sandstone, shale and graywacke; the volcanic rocks are tuff, ash, and lava flows. These rocks were originally deposited in nearly horizontal layers, mostly beneath the sea less than 125 million years ago.

The rocks were deformed, raised into mountains, and worn down again. This sequence of events was repeated several times. The current generation of mountains has crest-lines of generally accordant heights and, from afar, shows a smooth rounded outline. This regularity, upon closer examination, is found to be deceptive. Terrain of the mountain mass has been sharpened and incised by erosive forces; mountain glaciers have formed alpine scenery with sharp, saw-toothed ridge crests at higher elevations, and mountain streams have incised deep narrow valleys at lower elevations. The present coastline is rugged and is being rapidly worn away by waves.

*The Willapa Hills*—a region of coastal ranges, geologically similar to the Olympic Mountains. The similarity of the two regions lies in the composition of the rocks, in their geologic age, and in the way in which the rocks have been deformed. The difference lies in the fact that the total relief is less. Relief, though low, is sharp. In the south, especially, valleys are narrow and slopes rugged. Toward the north the region is a hilly lowland.

*The Puget Sound Trough*—a region of structural downwarp. Rocks similar to those exposed at high elevations in neighboring provinces have sagged down to form a trough, and are now buried by later sediments or are below sea level.

In most places the surface formations are unconsolidated layers of glacial outwash, river alluvium and coastal-plain sediments. The northern part of this region resembles a drowned coastline, with all the beautiful headlands and islands of such an area. The wide central and narrow southern parts are lowlands with scattered hills.

*The Cascade Mountains*—a complex mountain belt extending throughout Washington from north to south. It continues north into British Columbia and south into Oregon. The Cascade

Mountains were first uplifted in early Cenozoic time less than 60 million years ago. Metamorphic rocks of sedimentary origin and coarse-grained igneous rocks constitute the northern part. Their west northwest-trending structural features, inherited from an earlier period of mountain building, were cut obliquely by Cascade structures. In the central and southern section of the Cascade Mountains these rocks were buried under thicknesses of volcanic rocks which piled up to great heights.

Erosion planed this generation of the Cascade Mountains down to lowlands. With renewed uplift the mountains were elevated to their present position and display, showing crest lines that attest to their once nearly level condition.

Renewed volcanic activity has occurred during the last million years. This volcanism is explosive in character and has spewed up and distributed widely both lavas and fragmental volcanic materials. The five beautiful composite volcanoes, Mount Rainier, Baker, Glacier, Adams, and St. Helens, that tower above the general crest-line are the most spectacular results of this volcanism.

Mountain glaciers, which were widespread during glacial times, have carved great circular spaces and troughs on these volcanic peaks and have deposited vast accumulations of glacial debris at lower levels. The alpine summits throughout the northern Cascades were also carved by glaciers, and on some higher slopes glaciers are still present.

*Columbia Lava Plateau*—a large province, which extends into neighboring Oregon and Idaho, is almost unique in North America and only rarely duplicated on earth. It came into existence about 25 million years ago. Onto a pre-existing land surface were poured, through fissures, a series of thick but very fluid basalt lava flows. Their fluidity enabled them to flow long distances before solidifying, and to inundate valleys and lap around the hills.

Gradually the preexisting surface was covered to great depths. Sufficient time elapsed between flows so that soils formed, forests prospered, and lakes formed which were filled with sediments. Traces of these phenomena are preserved in thick sedimentary layers which lie

between volcano flows. Eventually, the outpourings ceased.

The surface of the area now stands well above sea level though it is a basin area relative to higher ground that surrounds it. Though the scenery is rough and spectacular in places, especially along stretches of major rivers, relief is generally low.

During glacial times, the great continental ice sheets reached the northeast edge of this province. The most unique glacial effects are the great southwest trending "coulees," which are remnants of river channels carved by enormous meltwater streams heavily charged with abrasive rock fragments.

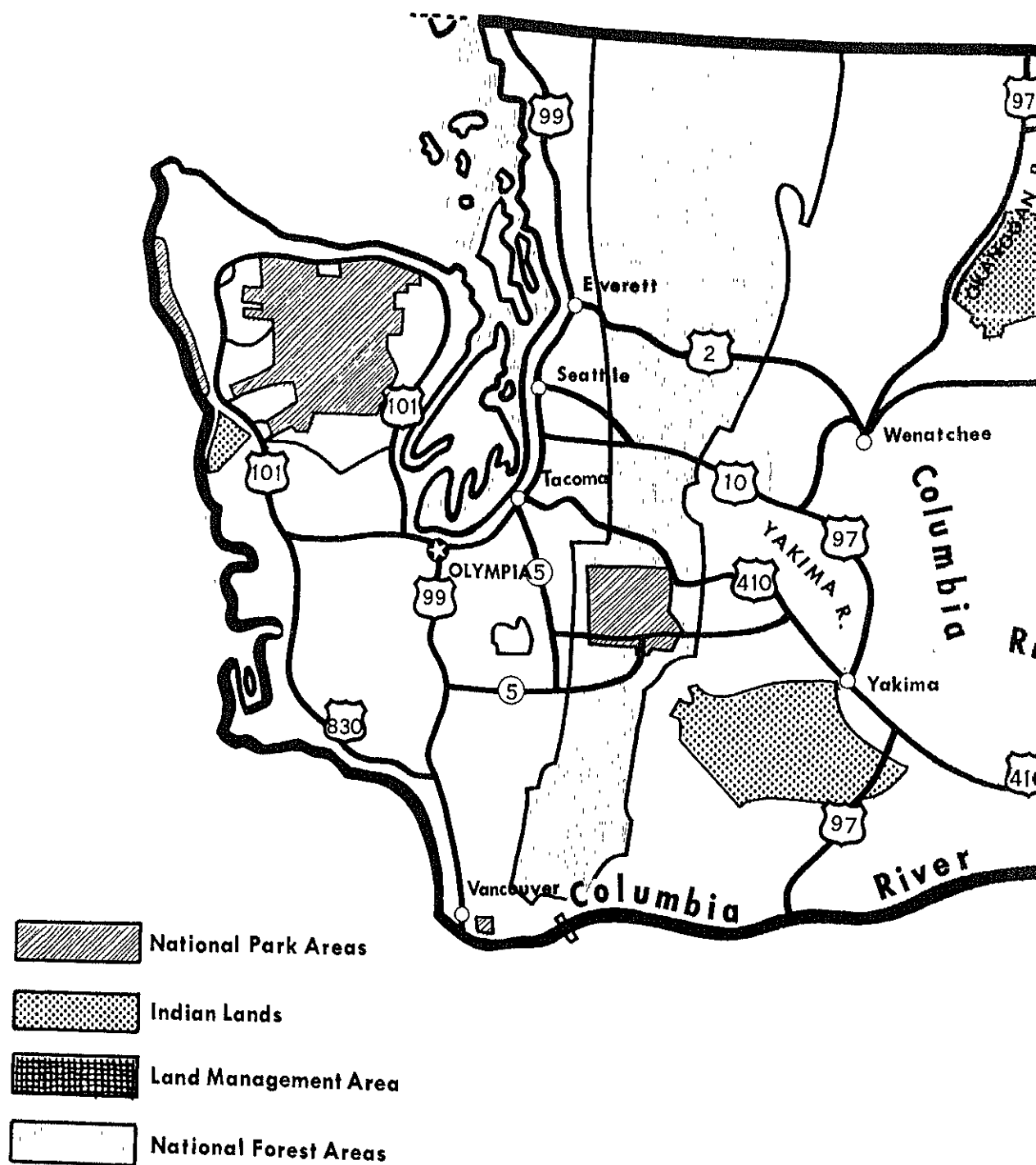
*Blue Mountains*—a small province, more extensive in Oregon, resembling the Columbia Lava Plateau. Several features, however, give it a far different physiographic expression. The basalt flows and interlaminated sediments have been uplifted and gently folded.

Relief being higher here than that to the north and west, streams have incised deep narrow valleys and have carved flat-topped uplands into narrow irregular ridges. In places, deep erosion has exhumed pre-lava topography.

*Okanogan Highlands*—older rock forms the surface bedrock almost everywhere, including rocks of many different ages. Some of the older rock series have been involved in several episodes of mountain building. Others remained undisturbed for immensely long periods. Meanwhile, thick series of sediments and volcanic flows accumulated in subsiding basins. Whatever their preceding histories, all rocks were involved in the climactic mountain-building event that largely determined the present geologic structure of all western North America.

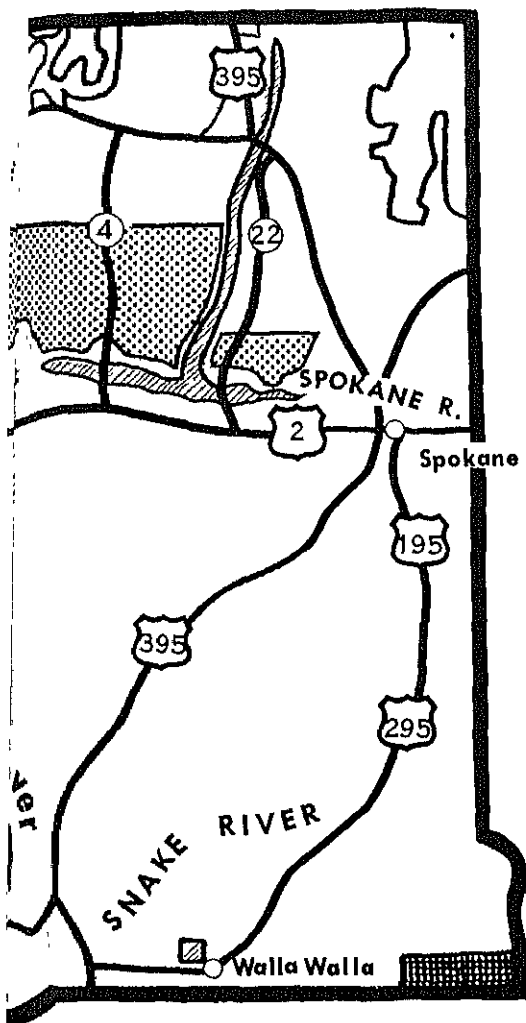
In the Okanogan Highlands since that time, geologic history consists mostly of slow gentle uplift and concurrent erosion. Rocks once buried to depths of several thousand feet and granites and other granite-like rocks which formed at these depths are now exposed to the surface. Though relief is high, the present surface expression is smooth; the region is one of gentle, rounded slopes, rounded summits and wide valleys. Continental ice sheets covered most of the Okanogan Highlands and effects of the glaciers are evident everywhere.

# Programs of Federal Natural





# Resource Agencies



## Resource Facilities

### *U.S. Army Corps of Engineers*

District Office, Seattle  
District Office, Walla Walla

### *Bonneville Power Administration*

Area and District Offices located in  
Seattle, Spokane, Walla Walla, and  
Wenatchee

### *Bureau of Commercial Fisheries*

Regional Office, Seattle  
Two Biological Laboratories, Seattle  
Technical Laboratory, Seattle  
Fishery Marketing Office, Seattle  
Enforcement Office, Seattle  
Marine Mammals Office, Seattle  
Loans and Grants Office, Seattle  
Reports Office, Seattle  
Exploratory Fishing Base, Seattle  
Fishery Statistics Office, Seattle  
Biological Laboratory, North Bonneville  
Salmon Cultural Laboratory, Longview  
Fish Nutrition Laboratory, Cook  
Fish Disease Laboratory, Seattle  
Fishery Management Station, Olympia

### *Bureau of Sports Fisheries and Wildlife*

Management and Enforcement Office,  
Seattle  
Predator and Rodent Control Office,  
Seattle  
River Basin Studies Office, Seattle  
National Fish Hatcheries:  
Longview  
Carson  
Entiat  
Leavenworth  
Cook (two)  
Wintrop  
Underwood  
Quilcene  
Major National Wildlife Refuges:  
Othello  
Colville  
Burbank  
Cheney  
Ilwaco

### *Forest Service, Department of Agriculture*

Forestry Research Center, Olympia  
Forestry Research Center, Wenatchee

### *Bureau of Indian Affairs*

Superintendent, Colville Agency, Colville  
Wapato Irrigation Project, Wapato  
Superintendent, Western Washington  
Agency, Everett  
Superintendent, Yakima Agency, Yakima  
Liaison Office, Seattle

### *Geological Survey*

Public Inquiries Office, Spokane  
Water Resources Engineer, Spokane  
Geologic Research Group, Spokane  
Hydraulic Engineering Office, Tacoma  
Groundwater Engineering Office, Tacoma  
Water Resources Engineer, Tacoma

### *Bureau of Land Management*

Land Office, Spokane

### *Bureau of Mines*

Health and Safety Office, Seattle  
Coal Research Laboratory, Seattle  
Nonmetallics Laboratory, Seattle  
Mining Research Office, Spokane  
Mineral Resources Office, Spokane

### *Bureau of Reclamation*

Columbia Basin Project Office,  
Field Divisions at Othello, Colville, and  
Upper Columbia Development  
Spokane  
Wenatchee Project Office, Wenatchee  
Yakima Project Office, Yakima

The natural resource functions of the Federal Agencies represented in this booklet are extensive and detailed and are only briefly described. Full information can be obtained by contacting the field offices listed on page 47 and elsewhere in this publication.



## Reclamation Programs in Washington

One of the Department of the Interior's largest reclamation projects is the Columbia Basin Project in Washington. A multipurpose irrigation, power, and flood control development utilizing a portion of the resources of the Columbia River, it is situated in the central part of the State. Its key feature is massive 550-foot-high Grand Coulee Dam, which is capable of impounding 9.4 million acre-feet of water in Franklin D. Roosevelt Lake, has an installed nameplate capacity of 1,974,000 kilowatts in its powerplant, and is expected to eventually furnish irrigation water for over a million acres of land.

Grand Coulee Dam contains 10¼ million cubic yards of concrete and its spillway creates a waterfall half as wide and twice as high as Niagara Falls.

Water for irrigation is pumped uphill from Franklin D. Roosevelt Lake by the Grand Coulee pumping plant through a short feeder canal into Banks Lake, an equalizing reservoir. The availability of abundant and inexpensive hydroelectric power is a prerequisite for any substantial development of irrigated lands utilizing water from the deep gorge of the Columbia, since the water must be pumped uphill to the plateau farmlands within the Big Bend of the river.

With the coming of irrigation to central Washington, dry farming devoted to cereal grains, which are generally price-supported and in surplus, has been giving way on irrigated lands to production of fruit, vegetables, and livestock, as farmers choose higher-value, more economically stable crops.

Another irrigation project under development by the Department's Bureau of Reclamation in Washington is the Chief Joseph Dam Project, made possible by the construction of Chief Joseph Dam on the Columbia River by the U.S. Army Corps of Engineers. On the Foster Creek Division near Bridgeport, Washington, a full water supply, pumped from the river into pipelines, is available to about 2,860 irrigable acres. The Greater Wenatchee Division, another Chief Joseph Dam project unit, is a single purpose project, providing a full water supply for orchard crops on 6,700 acres of arid land in Chelan and Douglas counties. The Oroville-Tonasket Unit of the Chief Joseph Dam Project is planned to eventually benefit 7,150 acres with a supplemental water supply and 1,500 acres of land not previously irrigated. Other Chief Joseph irrigation units and divisions are also under investigation.

In Okanogan County, the Bureau's Okanogan



The water impounded by the Tieton Dam in the mountains of Central Washington provides water for approximately 27,500 acres of fertile farmland and is also a retreat for those seeking outdoor recreation.

Project includes storage and distribution facilities to serve 5,307 acres of irrigable lands along the Okanogan River in the vicinity of Okanogan, Washington.

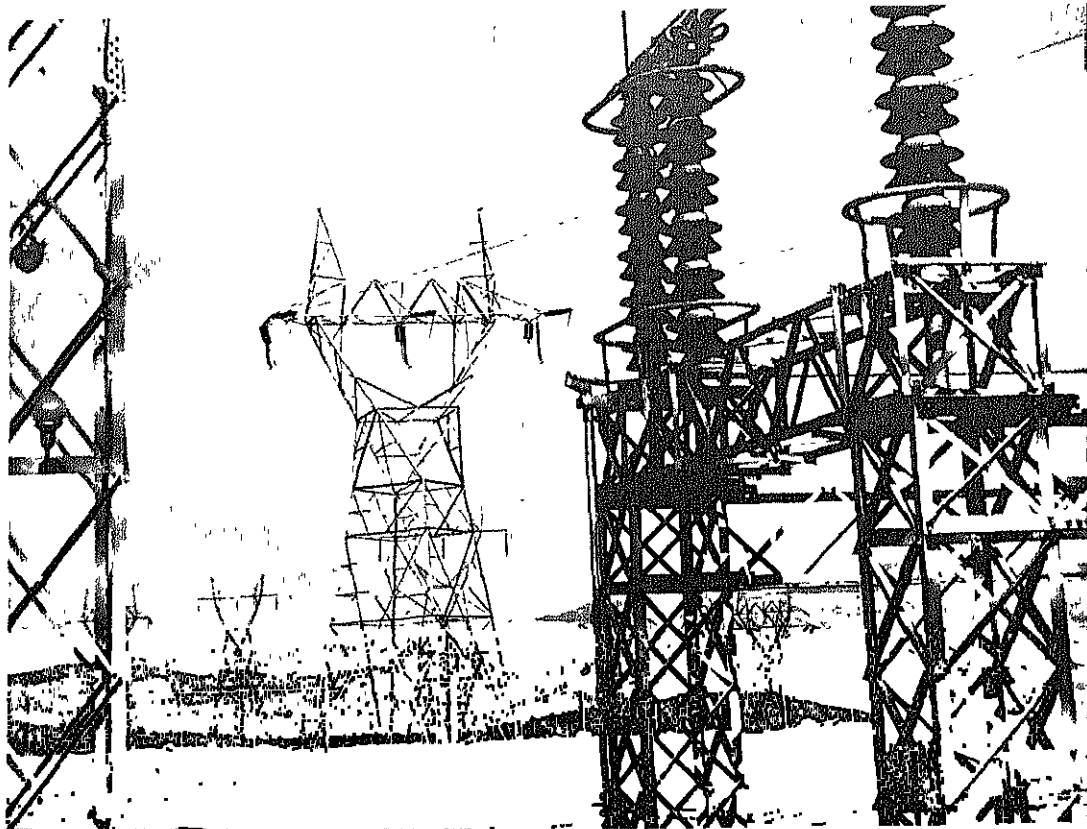
The Bureau's Yakima Project, in south-central Washington near the town of Yakima, provides irrigation water for a comparatively narrow strip of fertile land extending on both sides of the Yakima River, a tributary of the Columbia River. The irrigable land on the Yakima Project totals approximately 460,000 acres. Hydroelectric power is also generated.

Some of the reclamation project investigations which may play a part in the transition of agricultural potential of Washington into reality include:

Lower Horse Heaven Project in southern Benton County near the Columbia River, with an expected irrigable area of about 130,000 acres; Ahtanum Division, Yakima Project, in Yakima County; Chelalis River Basin in southwestern Washington, basinwide study of an area covering some 2,170 square miles; Eureka Flats Project in western Walla Walla County,

where feasibility of irrigation of some 12,600 acres is under investigation, Kennewick Division Extension, Yakima Project, in Benton County, comprising some 6,300 acres of new lands, Pend Oreille River Basin, basinwide study of an area of some 3,400 square miles in Washington and Idaho; Walla Walla Project, Washington-Oregon, with a total potential irrigated area of 60,000 acres, and Lower Snake River Basin which covers some 15,000 square miles in Idaho and Washington.

Among the divisions of the Chief Joseph Dam Project under consideration are the Chelan Division in Chelan County, with a potential irrigated area of almost 5,500 acres; Methow Division, where 13,000 acres are being investigated on a reconnaissance basis to determine need for supplemental and new water supplies; and Okanogan-Similkameen Division, White-stone-Coulee Unit, northern Okanogan County, where the possibilities of providing supplemental or full water supply for about 2,500 acres of land are under study



These transmission towers near Grand Coulee Dam carry power from the Grand Coulee Powerplant to a switchyard for conveyance to the Bonneville Power Administration lines, which will distribute it to the cities of Portland, Seattle, Spokane and throughout the surrounding area.



## Bonneville Power Administration Programs

Bonneville Power Administration, a bureau of the Department of the Interior and marketing agency for power generated by the Columbia River system, supplies nearly 69 percent, or a little over 23 billion kilowatt hours of the total electric generation in Washington.

Bonneville Power Administration, since the beginning of operations some 20 years ago, has supplied the State with nearly 228 billion kilowatt hours of hydroelectric power representing gross revenues from power sales of well over a half billion dollars. Power supplied to Washington from the U.S. Columbia River hydroelectric power plants since beginning of operations would supply the power requirements of the entire United States for over three months.

Bonneville Power Administration's high voltage grid to carry power from the Columbia River dams to the State's load centers represents over 5,200 circuit miles of transmission line and 122 substations, a plant investment in excess of \$284,000,000. BPA's grid serves as the "backbone" for the interconnected public and private utility systems of the State and the Northwest Power Pool.

Coordinated operations of all the utilities serving the State through the Northwest Power Pool assures fullest utilization of the available power resources, makes possible savings in operating and transmission costs, and makes feasible new projects where isolated operation would not be economical.



# U. S. Army Corps of Engineer Programs

The United States Army Corps of Engineers, under assignment by Congress, is charged with public civil works programs to control, regulate, and improve river and harbor resources, to administer laws pertaining to the preservation of navigable water, and to plan, construct, and operate flood control works.

The Corps has been active in the Evergreen State in navigation projects, power development projects, flood control projects, emergency flood control work, and in a continuing program of examinations and survey of water resource development projects.

## *Navigable Waters*

The State of Washington has thousands of miles of inland, as well as coastal, waterways that provide channels and berthing facilities to both deep-draft and shallow-draft vessels of every description and from every major port in the world. They take on and discharge cargoes and passengers, and utilize the mild climate and recreational advantages of this scenic northwest corner of the United States. From Blaine Harbor, at the United States-Canadian border, to the mouth of the Columbia River, and throughout the inland waters of the State of Washington, the Corps of Engineers is continually inspecting, improving, and maintaining the waterways to provide safe and efficient access to coastal and inland ports. The Corps has completed nearly twoscore navigation projects in the State.

Many of these projects which are based on the multiple use of water resources are familiar to many Americans—projects such as Bonneville Dam, the Dalles Dam, and McNary Dam.

In addition, the rapid growth of water-recreation activities, with the accompanying expansion of the pleasure-boat industry, has led to requests for small-boat mooring basins by many communities around Puget Sound and on other coastal and inland waters. The Corps of Engineers has provided breakwaters and other

contributions for the establishment or improvement of several such harbor facilities. Some of these works are at Blaine, Bellingham, Port Angeles, and Shilshole Bay at Seattle, and studies have been initiated for a number of additional boat basins in Washington.

## *Future Programs*

Further projects may be added to the Corps authorized program from time to time in response to area needs. Typically, such needs are brought to the attention of the Congress, which may direct the Corps to conduct an appropriate study to find ways of meeting the problems. After engineering, economic, and other needed investigations, which may include the holding of public hearings, findings are reviewed, submitted to State and Federal agencies, and, finally, transmitted to Congress. Congress may authorize the project for construction, or may incorporate it for authorization into a comprehensive basin plan. After authorization, the project will be designed and built in accordance with the authorizing act at a time and rate determined by the appropriation of funds by Congress.

At present Congress has directed the Corps to make investigations and reports on flood control, navigation, and related problems in various areas in Washington. Some of these investigations have been completed and the reports are before Congress. Others are in progress, and, as funds are made available, will be completed and submitted to Congress for its decision as to future action.

Following are brief summaries of major existing Corps water projects in Washington:

## *Bonneville Dam*

The existing project provides for a concrete, gravity-type dam across the Columbia River at Bonneville, Oreg., about 145 miles above the mouth of the river. The spillway section, 1,090

feet long with 18 gates, is between Bradford Island and the Washington shore. The powerhouse section containing 10 generating units with a total installed capacity of 518,400 kilowatts, as well as a single-lift ship lock 76 feet wide and 500 feet long with a normal lift of 59 feet, are between Bradford Island and the Oregon shore.

Fish facilities consist of two fish ladders each 1,312 feet long, a powerhouse fish-collection system which connects with the Bradford Island fish ladder, three fishlocks, six fingerling bypasses and auxiliary equipment.

The lock at Bonneville, designed for barge traffic and small oceangoing vessels, was opened to traffic in 1938. It has a minimum oversill depth of 24 feet, although a depth of 28 feet or more is available for about 95 percent of the time. Total investment in the project was \$83,239,395. Average annual navigation traffic for the 10-year period 1950-59 was 1,506,529 tons.

Power generated at Bonneville Dam and delivered to the transmission lines of the Department of the Interior's Bonneville Power Administration for marketing total around 3.5 million kilowatt-hours annually. Power revenues are deposited in the U.S. Treasury to the credit of the project including interest and amortization of the project.

#### *The Dalles Dam*

The Dalles Dam is located at the end of Bonneville pool, 192.5 miles above the mouth of the Columbia River and approximately 3 miles east of The Dalles, Oreg. The project has been in operation since March 1957. The project consists of a navigation lock, spillway, powerhouse, and nonoverflow dam sections, totaling about 8,700 feet in length.

The navigation lock, on the Washington shore, is 86 feet by 675 feet in clear plan dimensions and provides a minimum depth of 15 feet of water over the sills. Necessary guide walls and channel improvements are provided in the vicinity of the lock. The gate-controlled spillway, crest elevation 121 feet, is 1,370 feet long.

The 2,150-foot-long powerhouse is constructed of 14 units installed initially and substructure

for 8 additional units. Units are rated at 78,000 kilowatts each.

Fish facilities consist of two fish ladders (1,761 and 1,801 feet long), a powerhouse fish-collection system, a fish lock 24 feet in diameter, and auxiliary equipment. Downstream migrants have access to fish ladders and all other water passageways.

This multipurpose project provides a 25-mile slack-water pool for navigation, provides needed power-generating capacity to the Northwest Power Pool; reduces the pumping lift required for irrigation, and provides recreational possibilities to residents of the area.

The construction investment for The Dalles project with 14 generating units installed is estimated to be \$248 million. Funds from the sale of power are deposited in the U.S. Treasury to the credit of the project, including payment of operation and maintenance cost of power facilities, interest, and amortization of construction costs.

#### *McNary Lock and Dam*

McNary Lock and Dam, on the Columbia River 3 miles east of Umatilla, Oreg., is 292 miles upstream from the mouth of the river. It is a multiple-purpose project in the interest of navigation, power, irrigation, and other uses. Construction was initiated in 1947 and the last power unit was placed on the line in December 1956.

The dam includes a navigation lock, hydroelectric powerplant, spillway, abutment sections, and facilities for passage of migratory fish. The overall length of the structure is about 7,365 feet and the maximum effective height of the dam is 92 feet. The gate-controlled concrete spillway dam is 1,310 feet long.

The dam provides a slack-water channel to the port district of Walla, Walla, ports of Pasco and Kennewick, the Richland area and the lower 10 miles of the Snake River. The navigation lock is a single-lift type with maximum lift of 92 feet—one of the highest single-lift locks in the world—and has a clear length of 675 feet and width of 86 feet. About 4,800 vessels are locked through the dam annually.

Two fish ladders 30 feet wide are provided, one on each shore. In addition, a fish lock is between

the navigation lock and spillway. Supplemental attraction water supply for the powerhouse fish-collection system is furnished by a pumping plant downstream from the powerhouse.

McNary powerhouse has an installed generating capacity of 980,000 kilowatts in 14 units of 70,000 kilowatts each. The powerplant will generate in excess of 6 billion kilowatt hours of energy annually under average streamflow conditions. About 84 percent of its total investment and operation and maintenance costs, including interest, will be returned to the Federal Treasury by the sale of electrical energy.

### *Chief Joseph Dam*

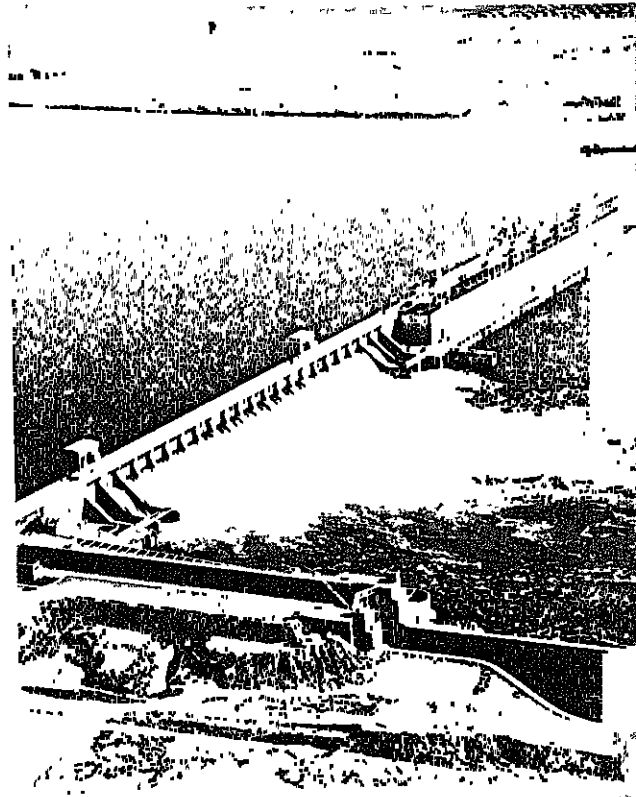
Chief Joseph Dam, on the Columbia River near Bridgeport in north-central Washington, is one of the main projects in the Federal Government's comprehensive water-resources development program in the Pacific Northwest. The project was essentially complete with the initial installation of 16 power units on the line, by the end of 1958. It was authorized primarily for the development of hydroelectric power. It develops that reach of the Columbia River from Grand Coulee Dam downstream to the head of the proposed reservoir pool to be formed by Wells Dam. Chief Joseph Dam's reservoir, officially named Rufus Woods Lake, is nearly 51 miles long.

The project consists of a concrete gravity dam 2,264 feet long and 220 feet high; the intake structure is 2,036 feet long and 150 feet high. The powerhouse will have an ultimate length of 2,036 feet for the planned 27 generating units. The first-phase installation, however, consists of 16 generating units, each with a rated capacity of 64,000 kilowatts (total 1,024,000 kilowatts), with substructure to accommodate an installation of 4 additional units. Space for the ultimate installation of 27 units is provided by the intake structure.

Chief Joseph Dam's total generation through 1960 has been over 21,765,491 megawatt-hours. (A megawatt-hour is 1,000 kilowatt-hours.) This output represents an approximate gross revenue of \$51,150,000 at the average kilowatt-hour power rate received for the Federal Government by the Bonneville Power Administration.

### *Mud Mountain Dam*

Mud Mountain Dam and Reservoir comprise a flood control project on the White River, about 6 miles southeast of Enumclaw. In connection with the Tacoma channel and levees, it protects the White and Puyallup River valleys and the city of Tacoma industrial area.



Looking upstream at McNary Lock and Dam, a U.S. Army Corps of Engineers' project on the Columbia River, showing the 7,300-foot-long multipurpose project with its lock, north and south shore fish ladders, spillway bays and powerhouse. The 38,800-acre reservoir stretches behind the dam 61 miles upstream.

With a height 425 feet above lowest bedrock, Mud Mountain Dam is one of the highest earthfill-rockfill dams in the world. The storage of 106,000 acre-feet of water provided by the reservoir is capable of controlling floods as high as 50 percent greater than the maximum discharge of record.

The flood control benefits derived from the project have averaged \$360,000 annually. Total Federal investment in the project is about \$15 million.



## Geological Survey Programs in Washington

The Geological Survey of the Department of the Interior has published 7½-minute topographic maps at 1:24,000 scale, and 15-minute topographic maps at 1:62,500 scale for about 60 percent of the State. The 7½-minute mapping, covering about 16 percent of the State, is located in scattered blocks in the vicinity of Bellingham, Port Townsend, Seattle, Tacoma, Aberdeen, Chinook, Vancouver, Yakima, Moses Lake, Spokane, and Colville.

The 15-minute mapping, about 44% of the State, is located generally in the western quarter of the State, and in the vicinity of Mt. Baker, Okanogan, Republic, Grand Coulee Dam, along the Snake River in southeast Washington, and along the Columbia River in the central and southern parts of the State.

The entire State of Washington is covered by maps of the 1:250,000 series, about 32 percent of which are now considered obsolete for scientific and engineering uses.

The State of Washington has a cooperative mapping program with the Geological Survey which began in 1910. Except for interruptions during 1926, 1932 through 1935, and 1938, this program has continued to the present time. The State also has an Advisory Board on surveys and maps which was established in 1955 under the Department of Public Lands.

A total of 9886 square miles of topographic mapping is in progress in the current program in Washington. Of this, about 800 square miles is cooperative mapping with the State Department of Natural Resources sharing the cost on a 50-50 basis. The balance of the mapping program is financed by Federal funds.

In general, the long-range plan for topographic mapping in Washington contemplates the completion of surveys for unmapped areas within the next 15 to 20 years at 1:24,000 (1 inch equals 2,000 feet) scale standards. In the early years, some of these will be published at 1:62,500 scale (1 inch equals 1 mile). Assuming that present trends continue, it is likely that 1:24,000 scale surveys will replace all of the

present 1:62,500 scale maps within the same period. Afterwards the program will consist primarily of map maintenance and revision to keep the maps up to date, plus whatever requirements for topographic mapping exist at that time.

All factors clearly indicate that Washington is moving into a new phase of development. With the vigor that is the spirit of the Northwest, it is apparent that the State has just begun to grow. The need for topographic maps will doubtless increase with the development programs in the State. One objective of the Geological Survey will be to recognize these needs and to keep pace with them in mapping programs as nearly as possible.

### *Geologic Program*

A wide variety of geologic investigations are in progress in the State of Washington.

Some of these are detailed studies concerned in large part with the mineral and mineral fuels resources of particular regions. Examples are investigations of deposits of high-alumina clays in the Greenacres quadrangle, and uranium deposits in the Mount Spokane quadrangle, both in Spokane County; coal and refractory clay deposits in parts of King County, being studied in cooperation with the Washington Department of Conservation; and mineral fuels in the Grays Harbor Basin, Grays Harbor and Pacific counties.

Other studies are concerned primarily with engineering geology, as, for example, the geologic study of the Puget Sound Basin to aid engineering construction, and landslide detection and control, the detailed geologic study of the Seattle Metropolitan area in cooperation with the Municipality of Metropolitan Seattle to aid planning of engineering construction in this rapidly growing metropolitan area; and a detailed investigation of the Osceola Mudflow, a large volcanic mudflow from Mt. Rainier.

Geologic mapping, an instrumental part of



### Continuing geologic research in the Evergreen State means new resource knowledge.

most of the studies listed above, is under way also in several other regions of the State, such as in the eastern part of the Olympic Peninsula, the northern part of the Cascade Mountains, and in several areas in northeastern Washington. The data derived from this mapping are helping to fill large gaps in our knowledge of the geologically less well-known parts of the Northwest. In addition, these studies will enable appraisals of potential minerals and fuels in the areas mapped and will aid in the planning of land development and engineering activities.

A new geologic map of Washington was published in 1961 by the Washington Department of Conservation. The new map is a compilation from all available sources showing geology in Washington

#### *Water Resources Studies*

The Geological Survey's program of water-resources investigations in Washington has as its objective the determination and description of the quantity and quality of the State's waters, on the surface and underground, whether under natural conditions or under conditions of present or potential development and use by man. The design of every power plant, municipal water-supply system, irrigation reservoir, or other engineering work for water development depends on these kinds of information.

At present, streamflow information is con-

tinuously obtained at 285 gauging stations strategically located throughout the State. Studies to determine the chemical quality of the surface waters are being made on about 70 streams. Studies to determine the source, quantity, movement, availability, quality, and utilization of ground water are now under way in many areas including Clark, Whitman, Lewis, King, Grant, Franklin, Adams, Pierce, and Thurston Counties.

Snow surveys are made to determine the depth and water content of snow in order to predict the availability of water for irrigation and power development. A special study is under way to determine the effects of logging on runoff. An investigation being conducted at South Cascade Glacier in the Cascade Range seeks knowledge of the water regimen of glaciers so that the peculiarities of glacier runoff can be known and utilized. It is believed that this study will aid in the extension of climatic records and thus in the assessment of water-resources trends. Other special studies include low flow analysis of small streams and flood frequency studies.

Much of the program of water-resources investigations in Washington is conducted in cooperation with State and local agencies.

#### *Production on Public Lands*

Currently there are in effect 1 coal lease and 6

coal permits involving 10,278 acres of public lands in Washington supervised by the Geological Survey. During 1961, there has been no production on these properties. On Indian lands, there are 1 coal lease, 24 metal, and 41 nonmetal permits and leases involving 6,459 acres from which during the year, production of sand and gravel amounted to 276,538 tons valued at \$124,479 with royalty of \$12,564. Production of limestone amounted to 71,974 tons valued at \$35,987 royalty of \$2,399. Production of uranium amounted to 169,446 tons valued at \$2,821,753 with royalty of \$334,948.

Fifty-six oil and gas leases embracing 32,274 acres of public lands and 59 oil and gas leases embracing 4,628 acres of Indian lands are under supervision. There have been no oil or gas

operations on Federal lands, but 3 wells now abandoned and 1 gas well now shut-in have been drilled on Indian lands in the State.

Some 691,801 acres have been withdrawn pending possible classification for coal and to date 141,444 acres have been so classified. No active coal producing projects are being conducted on public lands in Washington at present.

Information on the various geologic and topographic maps, mineral resources maps, water resources reports, and other geological survey publications relating to Washington can be obtained by writing the Director, Geological Survey, Department of the Interior, Washington 25, D.C.



## Bureau of Mines Programs in Washington

Development of Washington's mineral and metal resources is a continuing effort of the Department of the Interior's Bureau of Mines. Investigations now under way include field reconnaissances of sources of such Space-Age metals as beryllium, cesium, columbium, tantalum, lithium, rubidium, and tellurium. Tungsten deposits are the subject of a detailed field study. Other studies cover gold, copper, lead, zinc, manganese, iron, nickel, silica, clay, bauxite, chromium, limestone, and molybdenum deposits.

Washington iron ores are being investigated to supplement Bureau of Mines industry studies of the State's steel and ferroalloy industries, and a survey of sources of iron and steel scrap also is underway.

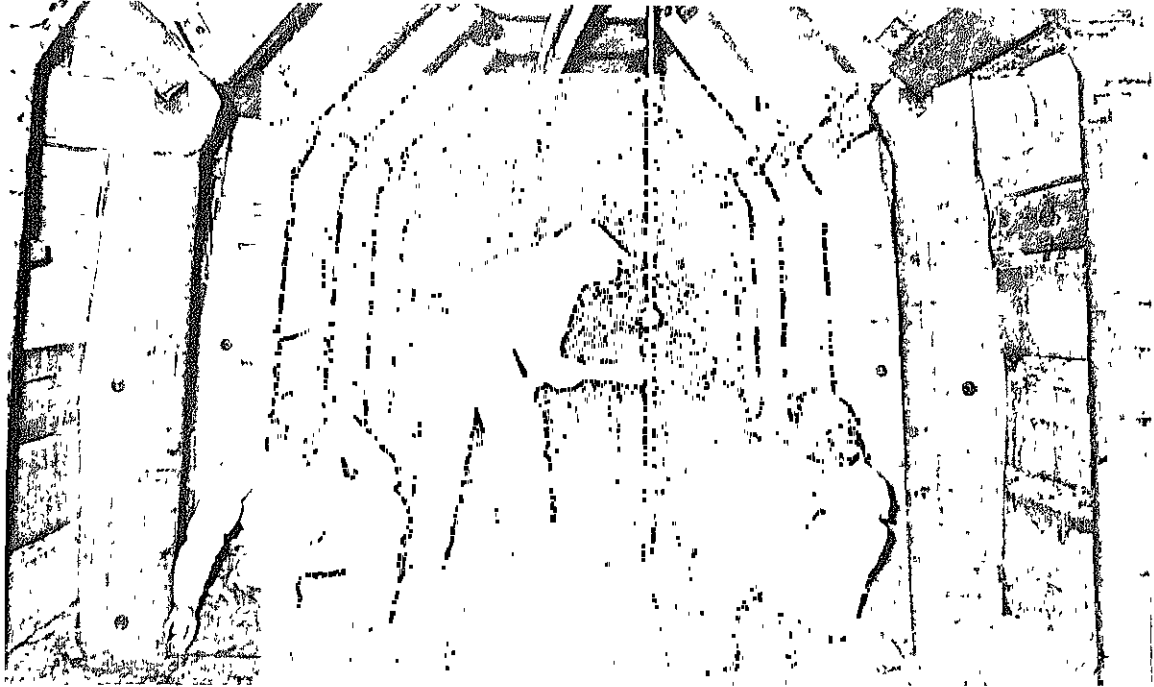
Metallurgical studies by Bureau laboratories have developed beneficiation and smelting processes for treating Washington magnetite beach sands and iron-nickel ores such as those occurring near Cle Elum. The Cle Elum deposit in Kittitas County was explored by the Bureau of Mines,

and approximately 6 million tons of ore, averaging 40 percent iron, 1 percent nickel, and 1.5 percent chrome, was revealed.

Similar work on the Buckhorn Mountain iron deposit, Okanogan County, developed inferred reserves of 2 million tons of ore averaging over 50 percent iron. This deposit is currently of interest to the Japanese steel industry which is a large importer of iron ore from western North America and views the Buckhorn ores as potential raw material for future export operations.

As an aid to current and future mining in Washington, the Bureau has published numerous methods-and-costs studies of mining operations in the State.

Clay deposits are being investigated to determine forming qualities and physical properties. In King and Pierce Counties, 30 deposits were recently evaluated and laboratory testing is continuing. Some of the clays have been found suitable for making both super-duty refractories and whiteware. In conjunction with resource



Engineers from the Bureau of Mines Office of Mining Research at Spokane are shown measuring the "closure" of concrete support sets in an underground passageway of a cooperating mine.

evaluation and testing, a study has been completed on building brick and ceramic and wall-tile markets in Washington. Other recent non-metallic minerals projects in the State have concerned silica deposits, resources of expanded aggregate, and sulphur availability.

Field teams made up of Bureau of Mines engineers and Geological Survey geologists have examined a number of Washington properties under the Government's program to encourage exploration for domestic sources of strategic and critical metals and minerals. This work—performed for the Department's Office of Mineral Exploration—resulted in 40 contracts in the State of Washington having a total value of \$2 million, and discovery of significant tonnages of ore. Government financial participation ranged from 50 to 75 percent. Loans are repayable from proceeds from the sale of ore discovered and subsequently mined. The largest contract was for \$310,000 for work at the Holden copper mine in Chelan County.

The Bureau of Mines examines hundreds of Washington prospectors' samples annually—helping to bring to light new mineral discoveries in the State.

Washington industries consuming raw mater-

ials not mined in the State also benefit from Bureau of Mines research. For example, economic studies of aluminum production and fabrication were recently completed, and beneficiation investigations of aluminum-plant residues are in progress.

Coal is an important mineral fuel in Washington, but production has been declining in recent years. Because of the large available reserves, work currently centers about mining handling, and preparation rather than discovery. Work on upgrading Pierce County coking coal has been instrumental in developing a Japanese export market. In cooperation with local industry the Bureau is developing new hydraulic mining methods. Work to improve washing and other preparation techniques is going forward. It is hoped that as a result of these and similar activities a strong coal industry will be reestablished in the State.

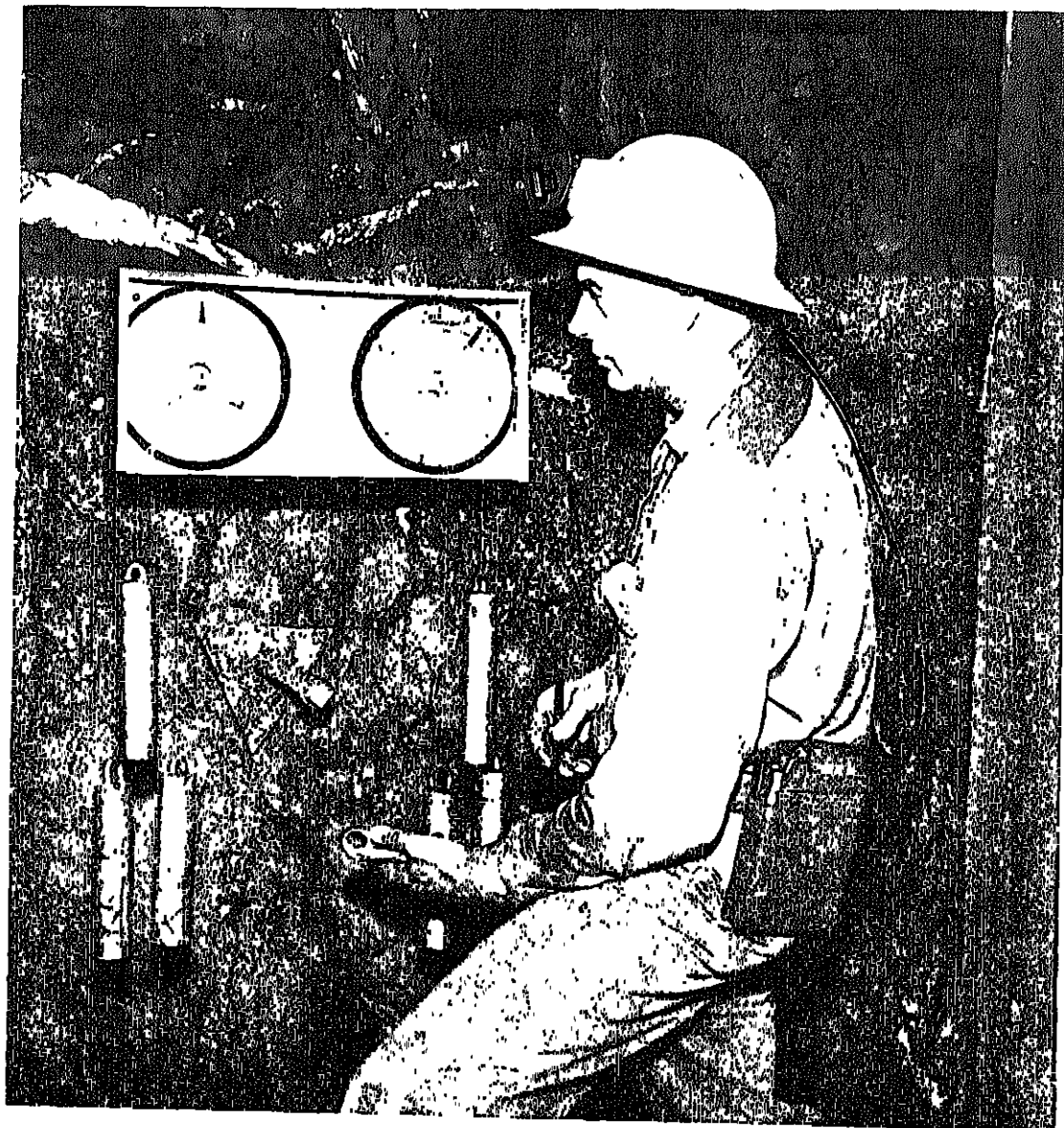
At its regional metallurgy research center in Albany, Oreg., and in other facilities throughout the United States the Bureau conducts research on metals and nonmetals found in Washington to determine and improve the qualities, thereby making them more useful and increasing demand for them.

The Bureau of Mines continues to play an active part in developing Washington's resources of metallic and nonmetallic minerals. Future programs promise to develop additional reserves as well as technologic and economic information for the State's expanding mineral industries.

In cooperation with private industry, the Bureau of Mines has also produced a motion-picture, "Washington and Its Natural Re-

sources," which shows the State's varied resources of minerals, land, water, and forests, and the diversified industry and agriculture based upon them. This 16 mm. sound and color film is available on short-term loan, without charge, to educational institutions, civic and business associations, engineering and scientific societies and other responsible organizations from the Bureau of Mines, Graphic Services, 4800 Forbes Avenue, Pittsburgh 13, Pa.

**A Bureau of Mines engineer from the Spokane Office of Mining Research is obtaining basic information on movement of wall rock inside a mine.**





## Programs of the Bureau of Indian Affairs

One of the oldest agencies of the Federal Government, the Department's Bureau of Indian Affairs today functions as trustee for lands owned by Indian tribes and individual Indians and provides Indian people living on trust lands with a wide variety of services in Washington.

Its basic aim is to help Indian people develop their human and natural resources and eventually take their place in the local and national society on an equal footing with other American citizens. These human and natural resources are an important asset to the State.

In Washington there now are 3 comparatively large Indian reservations—Colville, Yakima and Spokane—and 19 smaller ones which are administered by the Western Washington Agency at Everett. The total area of Indian land in trust status is over 2,500,000 acres. This includes about 1,800,000 acres of tribally owned land, over 700,000 acres of "allotments" owned by individual Indians on reservations, and nearly 37,000 acres of allotments on the public domain.

Currently living on these lands there are about 9,000 Indians—approximately 3,300 at Yakima, 1,600 at Colville, 350 at Spokane and 3,600 in the western Washington jurisdiction.

### *Development of Natural Resources*

The Indian lands in Washington are used principally for grazing, crop production and lumbering. Indian Bureau programs provide the land owners and land users with technical assistance in soil and moisture conservation, range management, forestry, and irrigation. In addition, the Bureau maintains about 1,800 miles of roads serving the reservation areas.

### *Irrigation*

Indians of Washington have been practicing irrigation on a limited scale for over 100 years. Federal assistance began in 1896 with the construction of a canal on what is now known as the Wapato Unit of the Yakima Indian Irri-

gation Project. Today this is one of the largest and most important Indian irrigation projects in the United States.

About 128,000 acres are now being irrigated on projects in Washington constructed by the Bureau of Indian Affairs and an additional 25,000 acres are classed as potentially irrigable. This acreage is located chiefly in three parts of the State. (1) in the south-central portion along the broad fertile valley of the Yakima River, (2) in the northwest area along the south bank of the Nooksack River near its confluence with Lummi Bay, and (3) in the north-central section on the upper basin of the Okanogan River drainage.

These lands are currently producing crops valued at about \$23 million a year. The principal products are hay, grains, potatoes, sugar beets, alfalfa seed, mint, hops, asparagus and fruit. In addition, the projects include a large acreage in irrigated pasture for the feeding of livestock and a number of large poultry ranches.

### *Forestry*

On the Indian reservations in Washington there are about 18.5 billion board feet of commercially valuable timber on approximately 1,800,000 acres of forested land. Western red cedar and western hemlock are the principal species in the western Washington jurisdiction; ponderosa pine predominates in the drier climate of the other reservations.

The Bureau of Indian Affairs provides fire protection for these forested lands and actively manages them on behalf of the Indian owners. In a recent year, the total timber harvest amounted to about 255 million board feet which were sold for nearly \$5 million. Up-to-date forest inventories recently completed by the Bureau indicate that the allowable annual cut can be increased to 380 million board feet.

### *Recreational Facilities and Potential*

Tourist attractions of various kinds can be found on practically all the Indian reservations

in Washington. The recreational facilities now available, however, represent only a minor portion of the resources of this kind which could potentially be developed.

Among the possibilities for future development are three artificial lakes (two proposed and one under construction) on the Yakima Reservation and a potential health resort at Soda Springs on the same reservation. Indian tribal groups of the State are evincing a growing interest in recreational development.

### *Development of Human Resources*

Since the State of Washington has assumed full responsibility for educating its Indian children, the Bureau of Indian Affairs has no schools of its own, either on or off reservations in the State.

The Bureau does, however, provide the State with financial assistance (currently about \$40,000 a year) for education of Indian children and it has active programs of adult education on the Colville and Yakima Reservations.

Indians on all Washington reservations are

eligible to receive assistance from the Bureau in relocating to off-reservation locations or in acquiring vocational training at Government expense in established private schools. Such training is available in seven Washington schools at Seattle, Tacoma, Vancouver, and Longview or in any of the eight cities of the West or Midwest where the Bureau has relocation offices.

The Bureau also conducts a credit program to help Indians obtain needed financing from the sources that serve other citizens, to provide direct loans in justifiable cases, and to furnish technical guidance for tribally financed lending operations. In a recent year the Indians of Washington obtained about \$2.1 million of financing from non-Bureau sources as compared with a little over \$1 million four years earlier. Washington tribes now have about \$1.3 million of their own funds for credit purposes. Loans have been used chiefly for farming, ranching, logging, fishing, home construction and improvement, business enterprises, and higher education.



## Bureau of Land Management Programs in Washington

The programs of the Department's Bureau of Land Management touch upon nearly every phase of natural resource management. In Washington BLM is responsible for about 365,000 acres of public land—part of the 477 million acres referred to by the President as a "vital national reserve."

### *Inventory*

An inventory of all the public land in the State has been made by the Bureau of Land Management. This requires careful and informed examination of the land to determine what uses will contribute the most to the State and the Nation. Tracts thought to have possible present or future value for recreation or

other public purposes are being brought to the attention of the State. Under a new pricing schedule, such lands may be purchased by the State for parks or school construction for \$2.50 an acre.

One of the most important BLM activities in the State of Washington is the completion of the school land selection program which was accelerated several years ago. The lands are valued at more than \$50 million.

### *Surface Resources*

The public lands are a rich storehouse of timber, forage for grazing for livestock and wildlife, water, and recreation potentials. BLM

The Bureau of Land Management conducts land inventory, forestry, and land survey functions on public domain lands in Washington, including transfer of land for school selection.



uses modern techniques to assure the highest flow of these values to the economy.

In one recent year, BLM sold more than 7 million board feet of timber from the national land reserve in Washington at a value of \$108,000. The State is selecting about half of the 190,000 acres of commercial timber lands. The remainder will be the base for a progressive forestry program by BLM. Programs of reseed-ing, fire and disease protection, access roads, and scientific logging methods assure a continuing yield of the valuable timber resources.

Most of the areas of the national land reserve valuable for recreation have been identified and referred to recreation agencies. Examination and review will continue, and potentially valuable lands will be set aside.

Titles to such important areas as Forest Townsend Historical Site and Ginkgo Petrified Forest State Park have been transferred to the State. Leases have been issued to the State for 35 islands of the San Juan group. Eastern Washington College bought a 21-acre site on Badger Lake, near Cheney, for educational purposes. BLM is also cooperating on the preservation of the Columbia River Gorge, and action is being taken on applications for several other areas.

Public lands in Washington provide forage for about 16,000 head of livestock for a portion of the year, and for deer, elk, and other wild animals. The grazing land is mostly in scattered tracts, and much of it is being chosen by the State as part of the school selections.

#### *Subsurface Resources*

BLM manages the public lands under the

principle of multiple use. Often the same land which is suitable for grazing, or which is forested, also contains valuable minerals. The mineral areas of Washington are being mapped by BLM as a part of the inventory of public lands.

The Bureau of Land Management investigates the validity of mining claims on public lands, and issues patents. Oil and gas production is handled on a lease basis, 37½ percent of all money received from rents and royalties is returned to the State.

It is anticipated that oil and gas leasing activity will be greatly increased in the near future in Washington. Research is being done to determine whether mineral production is feasible on the Outer Continental Shelf.

#### *Service Functions*

In addition to the resource management functions BLM also carries out valuable service functions.

One of these is the maintenance of the official records of the Federal land in Washington. These records show all changes of status for each tract, such as special reservations, rights-of-way, easements, withdrawal, appropriations and classifications. The Spokane Land Office offers services to the public as well as to governmental managers.

Another of the important service functions served by BLM is the surveying of all public lands. BLM cadastral engineers are the official land surveyors of the Federal Government. Their service is important to private and public land management in Washington.



## Forest Service Programs in Washington

The Forest Service of the U.S. Department of Agriculture administers more than 10 million acres of National Forest land in the State of Washington, cooperates with the State Forester in programs for protection and management of State and private forest lands, and continually researches new methods in forestry, range management, and related fields.

Vast forests cover more than half of the State's area. More than one-sixth of all the sawtimber in the Nation is harvested from these forests. Production of lumber and lumber goods is a leading industry here and some 250 billion board feet of lumber has been harvested from the forests of Washington during the past 100 years.

### *National Forest Administration*

There are nine National Forests within the State of Washington—seven administered by the Regional Forester for the Forest Service Pacific Northwest Region with headquarters in Portland, Oreg., the others administered by the Regional Forester, Forest Service Northern Region, Missoula, Mont.

The Forest Service manages the National Forests so as to accrue the greatest number of benefits and services for the American people over the years, as provided by the Multiple Use-Sustained Yield Act of 1960. Thus, for example, management of Washington's more than 6 million acres of National Forest commercial timberland is planned so as to improve game habitat and watershed, and to complement recreational use.

During the past fiscal year, 1,400,066 board feet of timber, valued at \$19,810,130, was cut on Washington's National Forests. Much of the State's high watershed area lies within these forests. The heavy precipitation which this land receives feeds many of the tributaries of the Columbia River, providing irrigation for croplands and reservoirs and hydroelectric power for industry. Here in these high-lying National Forests may be found summer range

for the grazing of livestock—26,225 head of cattle and 20,795 sheep during fiscal 1962.

Annually, some 4 million recreationists flock to these National Forests to camp, picnic, ski, hike, hunt, and fish. Salmon and steelhead abound in mountain streams and a wide variety of game animals await the hunter. Hunting and fishing are permitted on all National Forests, subject to State regulations.

To keep up with expanding demand and use of National Forest resources, the Forest Service has embarked on a "Development Program for the National Forests." This program is aimed at managing and developing all resources to meet the demands anticipated by 1972 and includes long-term planning toward the year 2000.

In terms of on-the-ground work, the development program in the State of Washington will mean: planting of 140,000 acres to trees; construction of 950 campgrounds and picnic areas; revegetation of 91,392 acres of depleted rangeland; construction of 546 miles of fence and 265 water developments; construction of 8,489 miles of multipurpose roads and 687 miles of trails, with supplemental work to be provided on an estimated additional 4,842 miles of roads to be constructed by timber purchasers; and stabilization of 11,000 acres toward management of sound watersheds.

### *State and Private Cooperation*

Forest Service technicians work with the State Forester of Washington to promote protection and management of State and private forests in such fields as forest pest control, forest and range fire prevention, forest fire control, tree planting, forest management, flood prevention, watershed protection, and rural area development.

Specific cooperative activities here during the past fiscal year include protection from fire of more than 12 million acres; tree planting of nearly 65,000 acres, and technical assistance





The Forest Service, U.S. Department of Agriculture, administers nearly half of Washington's forest lands on a multiple-use, sustained yield basis.

given woodland owners of some 70,000 acres through farm woodland management projects. In addition, through cooperation with State and private landowners, 21,000 acres were sprayed for the control of spruce budworm in fiscal 1962, and 258,269 trees were inspected for the detection of European pine shoot moth, the Forest Service cooperative program for blister rust control saw more than 5,000 forested Washington acres treated with antibiotics, and over 17,000 acres were aerially surveyed.

#### *Forest and Range Research*

Two Forest Service research projects, with laboratory facilities, are located in Washington—the forest hydrology project at Wenatchee, and the silviculture and animal damage control project at Olympia. In addition, much research benefiting and directly affecting Wash-

ington forests is done at the Forest Service Pacific Northwest Forest and Range Research Station located at Portland, Oreg.

Experimental watersheds, such as those conducted through the forest hydrology project at Wenatchee, are the most direct method of learning what happens to water and soil when timber is cut and roads are built. Studies made here have shown the amount of rainfall which reaches the ground through timber stands of varying density, condition, and species, and methods for prolonging the vital snowmelt during the summer months. Research has also shown methods for improving range and wildlife management by selective planting, rotation, and harvesting of vegetation.

Other research programs carry on the endless fight against forest diseases and insects, study forest recreation potential, seek improved methods of firefighting, and investigate various phases of forest economics.



## Fish and Wildlife Service Programs

Thirteen National Wildlife Refuges, eight National Fish Hatcheries and several laboratories devoted to fishery biological research, marine mammal investigations, fishery diseases, fish nutrition and fishery technology are among the Department's Fish and Wildlife Service programs in the State of Washington which contribute to resource development in that State and in many instances far beyond the State's border.

In addition, new emphasis is being given to methods of getting migrating salmon around stream obstructions; other investigations in and out of Washington relate to protecting reforestation projects from bird, rodent, and big game animal damage.

There is an exploratory fishing base in Seattle from which Fish and Wildlife Service vessels operate in seeking out commercial stocks of fish and shellfish. There also are marketing and market-news services, inspection of fishery products, fishery statistical programs, and provisions for certain financial aid to fishermen under the terms of Federal legislation.

One of the big Fish and Wildlife Service activities is centered around its responsibility in the Columbia River Fishery Development Program.

This program seeks to mitigate losses incurred by the salmon and steelhead trout which are the result of water project developments and dams in the Columbia River Basin. This is a cooperative program involving the Service and the States of Washington, Oregon, and Idaho. Besides other duties, the Service is the coordinating agency for the program.

The program consists primarily of the construction and operation of fish hatcheries, fish ladders, fish screens, and the clearance of debris from streams. It has been under way since 1949.

### *Fish Hatcheries*

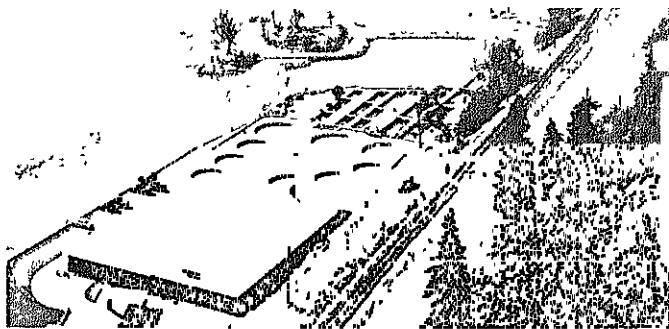
There have been 10 new fish hatcheries constructed and three others reconstructed in the Columbia River Fishery Development Program, financed by the Federal Government. Six of these are operated by the Washington Department of Fisheries for rearing salmon and two by the Washington Department of Game for producing steelheads. Five are operated by the Fish and Wildlife Service itself. In addition, the Fish and Wildlife Service operates three

The Turnbull Refuge, located at Cheney, is one of 13 National Wildlife Refuges in Washington for the protection of waterfowl, migratory birds, and big game.





Important nutrition and biochemical research on chinook salmon is conducted at the Willard Fish Nutrition Laboratory at Willard, Wash. The facility also serves as a national fish hatchery.



Among the 16 fish hatcheries in Washington, Spring Creek Hatchery on the Columbia River produces trout and salmon. These hatcheries maintain runs of steelhead and salmon in the Columbia River and supply trout and sport fish for other waters.

other fish hatcheries on the Columbia River and one on the Olympic Peninsula.

The eight fish hatcheries operated by the Fish and Wildlife Service on the Columbia River produce about 500,000 pounds of trout and salmon each year. The output of seven of these hatcheries is used primarily in maintaining runs of steelhead and salmon runs in the Columbia River, but three of these also supply trout for other waters. One hatchery, at Quilcene on the Olympic Peninsula, is devoted entirely to raising sport fish. The Federally operated hatcheries contributing to the Columbia River fishery are: Abernathy, Carson, Little White Salmon, Spring Creek, Willard, Leavenworth, Entiat, and Winthrop.

### *Laboratories*

The Fish and Wildlife Service has a fishery laboratory known as the Western Fish Disease Laboratory at the Sandpoint Naval Air Station near Seattle where research is done to combat various maladies which might strike fish in western waters. The Western Fish Nutrition Laboratory is located at Willard. It is concerned with the nutritional requirements of salmon and is especially alerted to any possibility of food as a cause for disease in fish. Other nutritional studies are made at the Salmon Cultural Laboratory at Longview. Pond design, water quality studies and hatchery techniques are also studied there. As in the case of the other laboratories, the results are made available to State, Federal, and private hatcheries.

Also in Seattle, the Service has three Fishery Biological Laboratories, one concerned principally with salmon, another with fish passage at dams, and the third with marine mammals. The salmon laboratory has two major research fields: High seas fisheries of the North Pacific Ocean and biology of Columbia River salmon. At the fish passage laboratory, devices and techniques are worked out for saving salmon when dams are built. The marine mammal laboratory deals mainly with the fur seals of the Pribilof Islands, but has a small study of the Pacific Coast whale resources.

The high seas research program is one of the most ambitious tasks ever undertaken in the biological field. Its purpose is to get data upon which the management of the Asian and American stocks of salmon can be based. The task entails operation of exploratory fishing stations at 60 mile intervals on a grid covering thousands of square miles of the North Pacific Ocean. It has required also that ways be devised by which salmon of North American origin could be distinguished from salmon of the same species of Asian stock.

### *Columbia River Project*

The work of the Columbia River biology project is conducted in Idaho, Oregon, and Washington rivers as well as in the laboratory at Seattle. Aside from this research but supplemental to it is an emergency program designed to get answers as soon as possible regarding effective means of

salmon and steelhead around  
ular importance since it is an  
the loss of the salmon and  
in some parts of the Columbia  
h are sought for water and  
nts.

the plantings of salmon and  
olumbia River system, the Fish  
ice also plants trout in lakes  
lateral lands. More than 15,000  
ed trout are planted on Indian  
year. More than 20 lakes on  
Olympic National Parks get  
from Service hatcheries, ad-  
s done in streams in National

### *Washington*

Wildlife Refuges in Washing-  
from a small five-acre refuge  
es of small islands in Gray's  
,000-acre refuge called Little  
ne small refuge, Copalis, is  
orants, guillemots, petrels,  
l auklets. Little Pend Oreille  
ucks and geese primarily, but  
e-tailed deer, the blue, ruffed,  
e, and numerous songbirds.  
s, six are set aside primaily  
ven are for migratory birds  
owl.

, and approximate location of  
dlife Refuges in Washington  
27,693 acres, 50 miles north  
hhello; Little Pend Oreille,  
miles east of Colville in the  
ne State; McNary, 2,849 acres,  
ers reservoir on the Columbia  
7,174 acres, six miles south-

acres, on the south end of  
alis, 5 acres, on a string of  
ray's Harbor; Flattery Rocks  
Needles, 125 and 117 acres  
ffshore islands extending 50  
om Cape Flattery; Dungeness,  
les from Sequim; Jones Island,  
n Juan group in Puget Sound;  
Matia, 145 acres, also in the

San Juan group; Smith Island, 65 acres, north of  
Everett.

The Service has recommended that another  
refuge be acquired in conjunction with the  
reservoir created by the John Day dam on the  
Columbia River. There will be about 18,000  
acres in this refuge. Additional areas totaling  
nearly 60,000 acres are also being considered for  
refuge purposes.

The Washington Department of Game receives  
about \$300,000 annually in Federal aid for the  
Restoration of Wildlife and \$100,000 for the  
Restoration of Fish. These funds, together with  
State funds, are used for the acquisition of  
hunting and fishing areas and for various types  
of research.

The Service also conducts the river basin  
studies required to determine the effect of various  
river and reservoir projects upon the fish and  
wildlife resource and to make recommendations  
for mitigation and enhancement of the resource  
through area acquisition, minimum stream-  
flows, and other means.

### *Other Activities*

The Fish and Wildlife Service has many other  
economic activities in Washington.

Research on starling control is conducted in  
the State to develop methods to prevent damage  
to the important fruit-growing industry in  
cooperation with the State Department of  
Agriculture and State Fruit Commission. Serv-  
ice personnel work at Olympia in an enlarged  
and intensified research program aimed at  
controlling wildlife species which pose a serious  
problem in reforestation and other phases of  
timber management.

A cooperative program to control predatory  
animals and rodents is carried out under service  
supervision in conjunction with State agencies  
and livestock and farm organizations.

The Service conducts an extensive depredation  
control program. In the Columbia Basin,  
assistance is provided wheat farmers in control-  
ling Canada goose depredations to spring wheat.  
Control procedures are evaluated for protection  
of valuable fruit and berry crops from damage  
caused by wild pigeons.

The Service has four Game Management  
Agents stationed in Washington whose primary

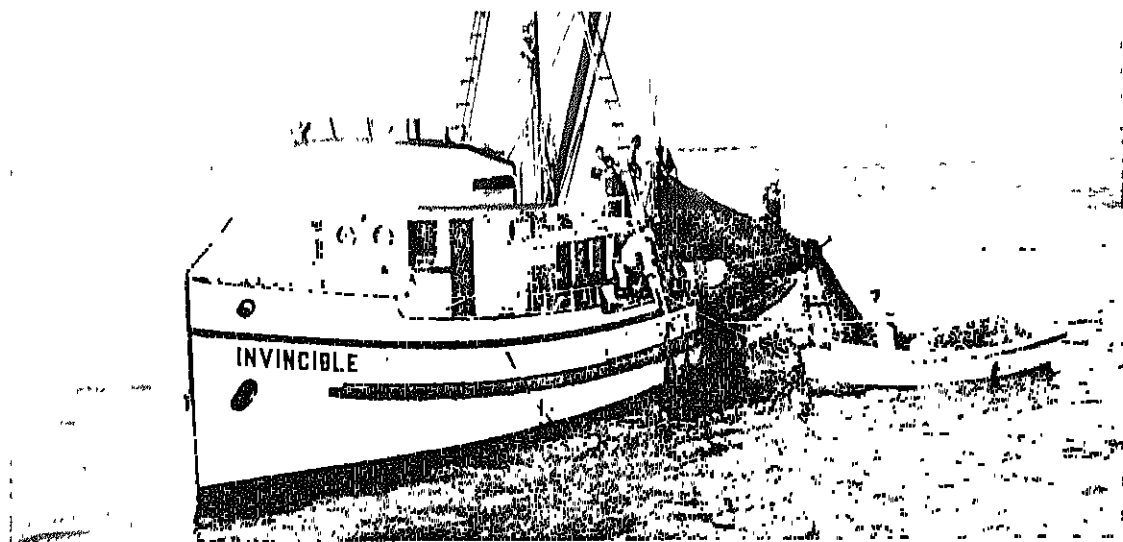
responsibility is enforcement of the 11 Federal laws and acts pertaining to conservation of the fish and wildlife resource. The program is coordinated with the Department's National Park Service to assist in the enforcement of game laws in national parks and with the Bureau of Indian Affairs. Game Management Agents participate in the annual winter waterfowl survey and annual mourning dove survey.

Two Federal Fishery Management Agents in Washington are concerned with the enforcement of the provisions of five international fishery treaties and the laws and regulations adopted pursuant to these treaties. This program is

for developing new fish and shellfish cookery recipes for household application, utilizing primarily those species taken commercially by the States of Washington, Oregon, and Alaska.

The Service also maintains a marketing office in conjunction with its test kitchen at Seattle. Inasmuch as Washington-produced fishery products are marketed throughout the country, a significant amount of the marketing effort of Service installations throughout the United States is directed at expanding the use of Washington-produced fishery products.

An expanded program designed to increase the quality and consumption of commercial fishery



A salmon seiner hauls in the first half of its seine net off San Juan Island, Puget Sound. Salmon vie with halibut for the lead in the annual harvest of commercial fish in Washington.

closely coordinated with those of the State of Washington and the U.S. Coast Guard.

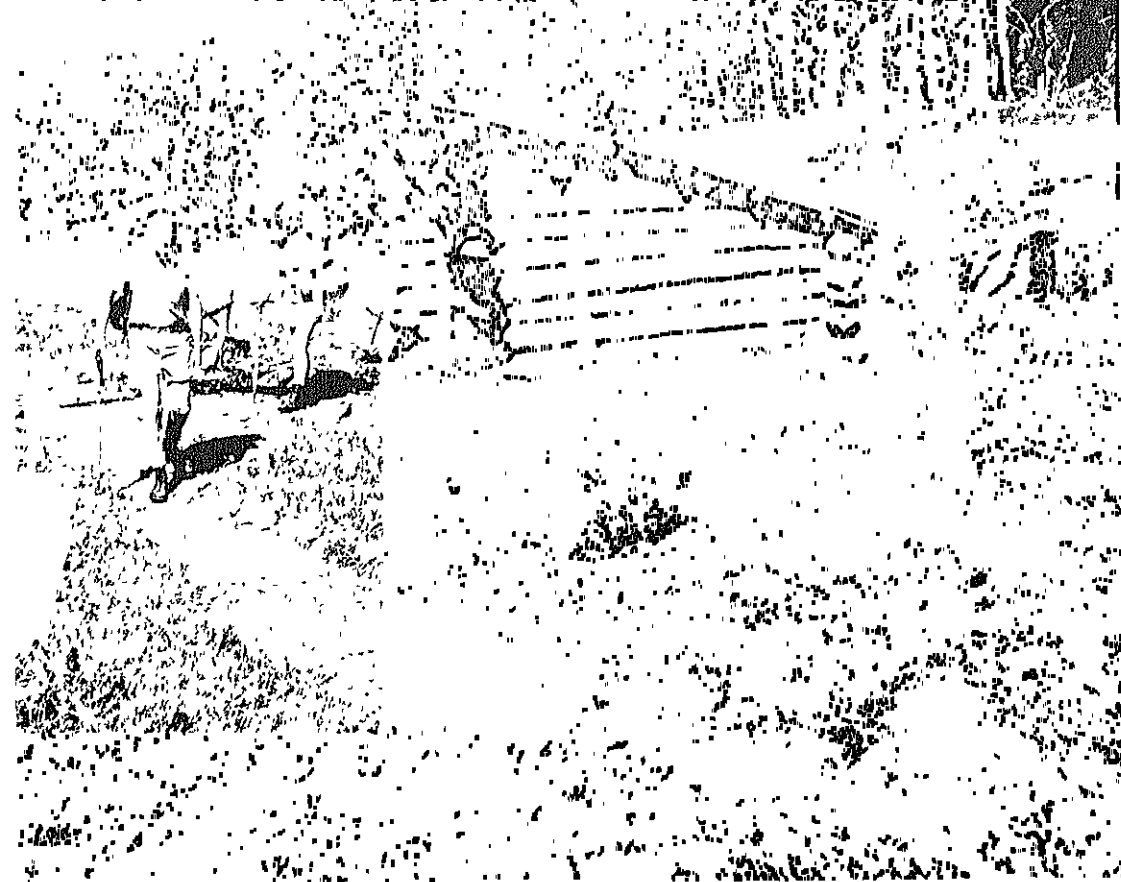
### *Commercial Fisheries*

Research on the radiation preservation of commercial fishery resources of Washington State is under way at the Fisheries Technological Laboratory in Seattle. The object of this program is to extend the markets for fresh fish to inland areas which must presently rely on frozen products from the sea.

The Service also maintains a small consumer-type test kitchen in Seattle. The home economist stationed at this test kitchen is responsible

products of the State has been under way at the Seattle Fisheries Technological Laboratory for the past several years. Under this program, U.S. standards of grades for northwest fishery products are developed for the use of the fish processing industry.

A major field office of the Service's Fishery Market News Service is also located in Seattle. It collects and disseminates regularly and promptly accurate and complete marketing information on fishery products and byproducts, current trends, developments, and research findings in this country and foreign countries of interest to fishermen, processors and allied industries of the United States.



Shelters are constructed along National Park hiking trails in Washington.



## National Park Service Programs

The National Park Service administers four as in Washington: Mount Rainier and Olympic National Parks, Whitman National Monument and Fort Vancouver National Historic Site, described earlier in this book.

Under a continuing long-range program of development of areas in the National Park System, the Service works constantly to improve Washington park areas.

For example, tourists will find more and more campsites available as well as picnic tables for many visitors. Even on the busiest weekend of summer, there will be adequate facilities. Furthermore, a major picnic area is being developed at the Paradise campground in Mount Rainier.

A survey is underway to determine needs over

the next 10 years for additional camping, picnicking, and hiking facilities as well as overnight accommodations. The survey will suggest economically feasible, modern replacement facilities which recognize the National Park Service regulations governing the type and location of such facilities. The areas to be surveyed include Paradise Valley, the so-called Crystal Creek area, the Klickitat Creek area, and the Longmire site, and others.

Other Park Service conservation and development programs in Washington include: a new suspension bridge over the Ohanapeccosh River; a nature trail to the Grove of the Patriarchs; continued expansion and improvement of campgrounds and access roads adequate to meet increasing public-use requirements; reconstruction

tion of roads, development of new roads; parking areas and visitor centers. Work at Mora and Rialto Beach areas includes development of water, sewer, and electrical systems and installation of equipment for their efficient operation and use.

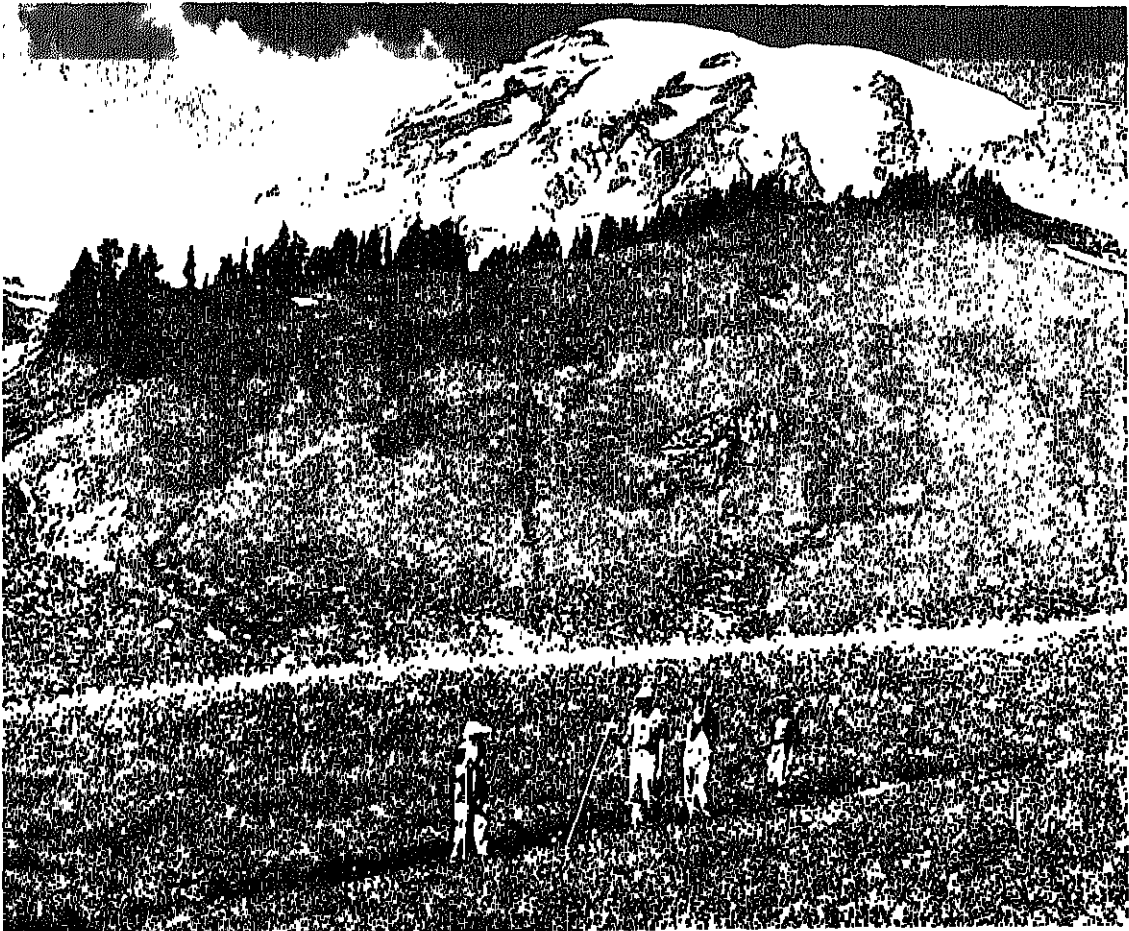
The State of Washington contains one of the few great wilderness areas remaining in the United States and the principal objective of the Service is the preservation of this primitive aspect. In order to preserve the wilderness character of these areas and still provide facilities for the pleasure of the hordes of anticipated visitors in 1966 and earlier, future road construction will be limited to the periphery of the wilderness areas.

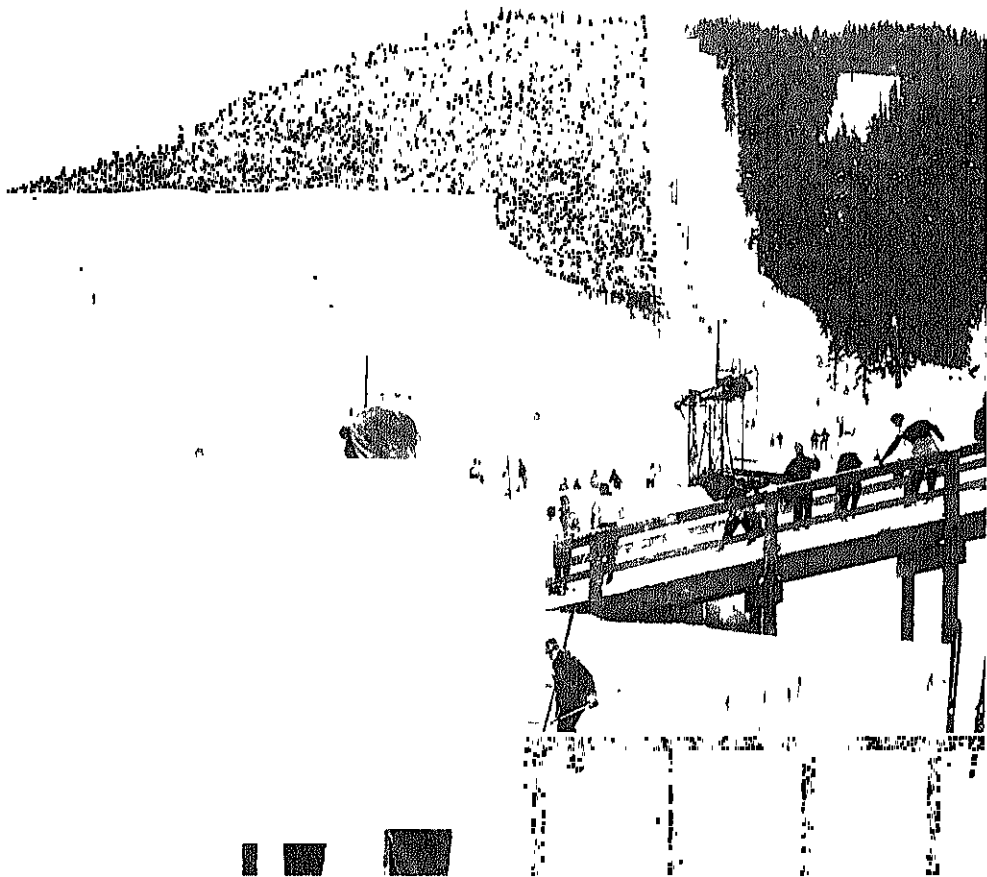
By 1966, park visitors to the Evergreen State will find many projects completed for public use

and enjoyment as well as interpretation of the parks and monuments. These facilities include: ranger stations, comfort stations, picnic tables, fireplaces, interpretive signs and markers, trail-side shelters, as well as major and minor road construction. There will also be information centers, campground development and campfire circles.

However, the real accomplishments of the Park Service's long-range programs are measured, not by miles of new roads, increased capacities of lodges, campgrounds, or by the number of new public buildings, but by how well the program as a whole accomplishes the purpose of National Parks—to preserve the Nation's heritage in wild lands, scenery, and historic treasures for the enjoyment and inspiration of Americans.

**Mount Rainier National Park in Washington is noted for its alpine meadows and flowers.**





White Pass Terminal Lodge, near Yakima, is a prime attraction for winter outdoor recreationists.



## Bureau of Outdoor Recreation

Although the Bureau of Outdoor Recreation manages no land, its functions serve to increase the supply of outdoor recreation opportunities within Washington, for the benefit of State citizens and tourists.

The Bureau provides technical services and planning and survey assistance in outdoor recreation to State and local governments. It also assists in preparing standards for State-wide recreation plans, and upon authorization by Congress, will administer Federal financial grants-in-aid for State recreation planning,

acquisition and development.

The Bureau, created by Presidential Order and established in the Department of the Interior in the spring of 1962, correlates related outdoor recreation programs of the various Federal agencies and bureaus operating in Washington. It is responsible for formulating a nationwide outdoor recreation policy and plan, based on State, regional and Federal plans. The Bureau sponsors and conducts recreation research, and encourages interstate and regional cooperation in outdoor recreation projects.



## Summary

Washington, the Evergreen State, as you have seen from this booklet, is an area rich in natural resources of land, water, timber, fish and wild-life, as well as tremendously endowed with scenic beauty and recreational lands.

The State is an area of the future whose development has stemmed and will continue to progress because the people of Washington know the value of wise conservation, intelligent development, sustained management, and wise use of the resources which Nature has bequeathed them.

Once an area being rapidly despoiled by man, the pendulum has swung full turn as the people of the Pacific Northwest, among the most progressive in the Nation, work diligently to insure the future of their area.

The Department of the Interior has played an important role in building the Evergreen State and will continue, in the years ahead, its solid support for a finer, better Washington.

Rivers in the mountain wilderness of Olympic National Park provide sport fishing for the recreationist.



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